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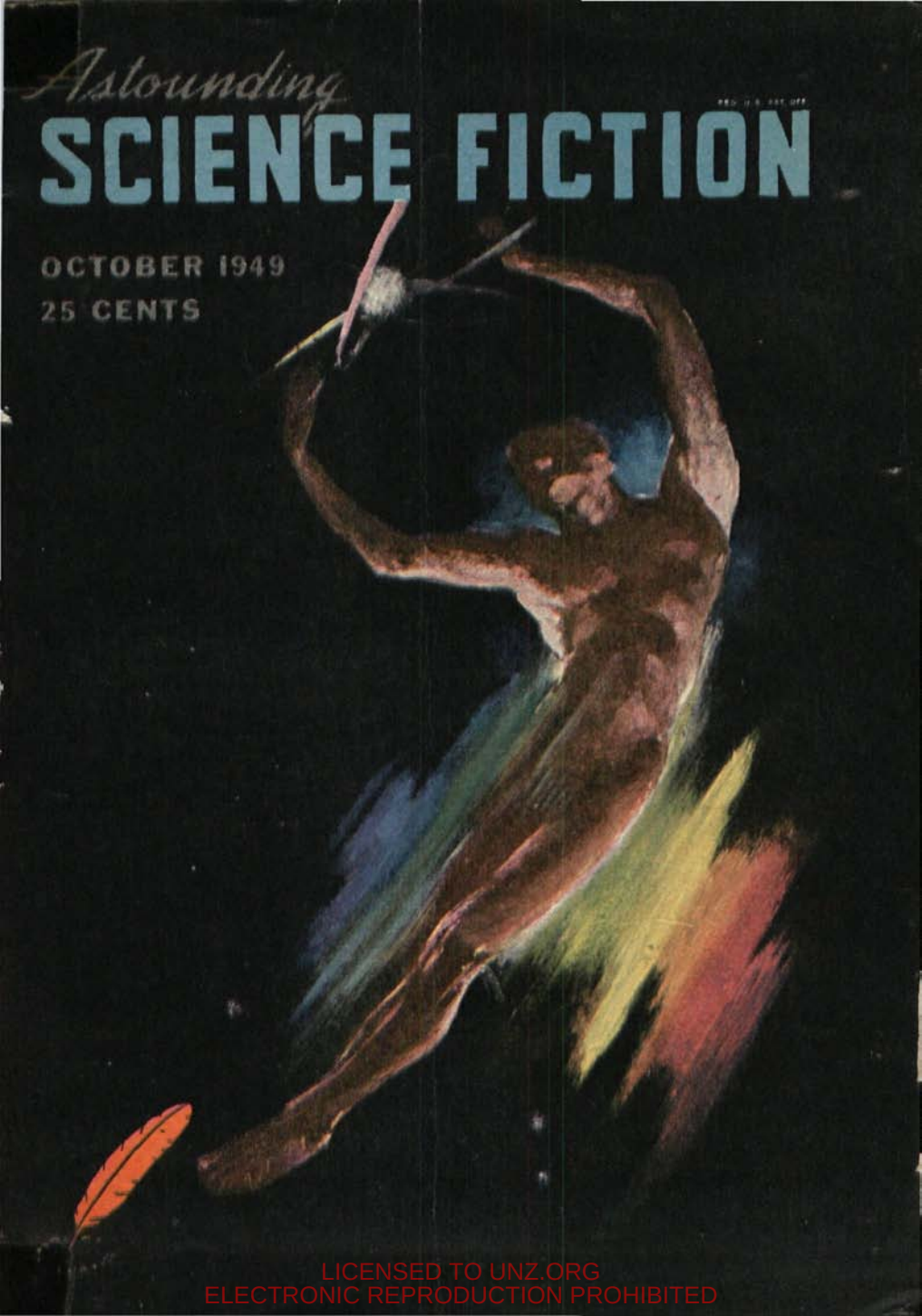

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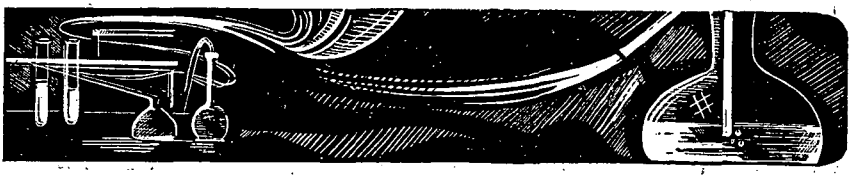

HIGH ENERGY

"These are minimums—particles that have slowed down to low-energy levels. We aren't interested in the slow ones." The cosmic-ray specialist pointed out a short, dark, broad trace on the photograph.

"Slow . . . low energy— How slow, and how low energy?"

"Mostly protons below a billion volts."

To the cosmic-ray specialist, billion-volt energies are the low, tag-end of speed range, the tired remnant of original velocity. Particles with energies over ten thousand million million volts have been recorded. A million million volts is common, for the primary cosmic rays. And therein lies a major part of the problem.

Consider: The fission of the uranium atom yields about two hundred million volts, of which about seventy-five million is carried by each of the fission halves. The conversion of the mass of a proton—hydrogen atom—entirely to free energy would yield about one billion volts; the total annihilation of a uranium atom would yield about two hundred billion volts, therefore. But two hundred billion volts—the maximum energy the annihilation of the heaviest natural atom could yield—is down in the region the cosmic-ray specialists consider uninteresting—approaching the "minimums" stage. Imagining a collision between two uranium atoms that released all their energy wouldn't help—it's not a question of a few times more energy, but of a factor of ten thousand times more we need to explain.

The energies displayed by single cosmic ray particles are so stupendous that no remotely conceivable single-event energy source could do it. The total amount of energy in cosmic rays is so enormous, apparently, as to require an explanation of wide scope. In other words, cosmic rays must be explained by describing an energy source that is:

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1. Capable of producing immensely high energy particles, enormously beyond the intensity of any possible nuclear reaction.
2. Of so wide-spread a nature as to be capable of accounting for an immense *quantity* of energy.

Cosmic radiation is immense, both in intensity *and in quantity*. That quantity appears to be about equal to the total quantity of energy in starlight. Dilute, true—no great amount per cubic mile of space. But intergalactic space isn't measured in cubic miles, or cubic parsecs, even. Call it so many cubic light-eras, rather than light-years.

Of answers we have practically none; theories seem to be plentiful, but as yet are, due to lack of data, so loosely knit that no clear picture is possible—or even a vague outline! For example, the above statement that there is a stupendous total quantity of energy in cosmic rays carries a proviso; *provided* the cosmic ray particles are uniformly—or roughly uniformly—distributed throughout space. It has been suggested by some specialists in the field that they aren't cosmic rays at all, but particles that have been trapped in the Sun's magnetic field so long they're now wandering in tight orbits through and around that magnetic field. That they're *solar* not cosmic in distribution. That, of course, would mean vastly less total quantity of cosmic energy.

One of the suggested sources of the immense energy of the particles is the action of the magnetic fields of stars on ionized particles in space. In effect, the shifting magnetic fields of stars acting something like a cosmic slingshot to accelerate and hurl onward individual nuclei. After all, if you transfer even a small part of the momentum of a star traveling one hundred miles per second to an individual atomic nucleus—the nucleus will have a fantastic velocity! In this connection, it's worth noting that a proton having the observed energy of ten thousand million million volts would have a mass ten million times normal, due to the operation of the Einstein relativity mass-speed effects. It would be a hydrogen nucleus five thousand times heavier than a uranium atom!

But these high-energy particles are not all fast protons; studies now going on have already shown that many of the primary particles are such massive nuclei as calcium, iron, and the like. In fact, the distribution of atomic weights indicates that the cosmic ray particles have an assortment of nuclei very much like that found in the vast clouds of gaseous matter in interstellar space. They appear to be, one might say, a small sample of the universal gas that has been accelerated to something over 99.999% of the speed of light!

Hm-m-m—wonder what the "wake" of a spaceship traveling between the stars at light-speeds would be like? What waves it would stir up to dash up on the beaches of far away planets. . . .

The Editor.

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THE ARISTOCRAT

BY CHAN DAVIS

Elder Stevan had a job to do—a hard, thankless task for a man born sick in a sick world. And it was doubly hard to see which way progress lay—for either side!

Illustrated by Brush

I.

It was an hour or so after sunset on a heavy September night. I was sitting alone in the high-ceilinged main room of the Temple, reading by the light of a five-foot candelabrum. The corners of the room were dark, as always; the white tree trunks outside the window seemed to catch more of the light than the piles of books which lined the walls.

The silence was broken by a loud but patient knocking at the door.

"Who would enter?" I called.

"Jim Jenkins. See the Elder Stevan."

I laid down my book. "Enter, Jim Jenkins." He came in and stood just a few yards inside the door, blinking at the candlelight. Jenkins was in his late forties, graying, but still one of the best farmers in the Village. Like all the Folk he had a round and almost chinless face, and just now its gray-shot eyebrows were drawn together in uncertainty. He stood just at the limit of the candles' light and shifted from one foot to another.

"What would you ask the Elder Stevan?"

"Elder Stevan," he said, "Paul Pomroy wants to marry my daughter."

"Your daughter—"

"Grace Jenkins."

I searched my memory. I had not seen the girl since she last came to the Temple, several years before. "Bring me the Record, Jim Jenkins."

With clumsy respect, he crossed the room, got the high, thin book, and, holding it in both hands, brought it to me. "She's young," I said, after a moment.

Jim Jenkins looked troubled. "Paul Pomroy wants to marry my daughter," he repeated.

I considered. He sounded pretty

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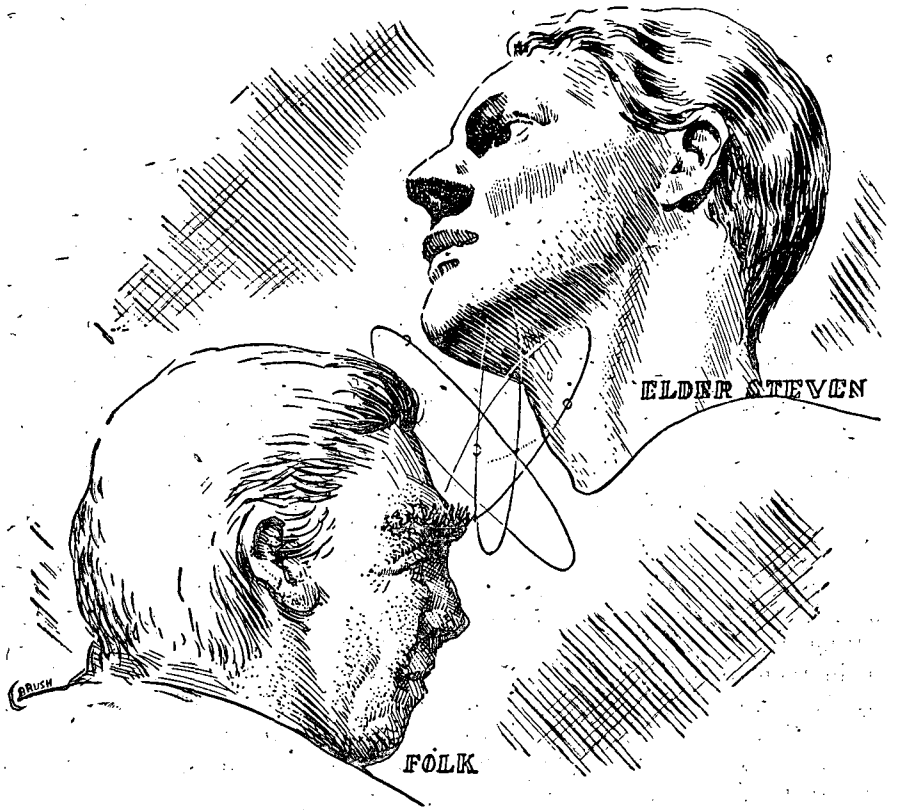

insistent, and it behooved me as a priest of Truth to recognize a fact, preferably in advance. Besides, there was definitely a percentage in my doing Jenkins a favor at this point. I spoke, sternly. "You have room for Pomroy and Grace in your house?"

"Yes."

"Jim Jenkins, they may marry, but because Grace is young they live and work with you for one year."

"Yes, Elder Stevan." He turned, thinking the interview was over.

But it wasn't. There was my very necessary percentage to collect—very necessary indeed, at this particular time. And I couldn't have asked for a better one to collect it from than him. "Jim Jenkins! You know Old Red has gone to the west with Buddy Hoey and others to forage. How long have they been gone?"

"Ten days, more."

"Thirteen days. You know they went against the word of the Elder?"

He half-whispered, "Yes."

"Do you expect the Elder will

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punish them when they come back?"

He frowned a little, apparently suspecting a trick. "Yes, Elder Stevan."

"The others in the Village—do they expect it also?"

"Some do."

"Do they wish it?"

"The Word of the Elder—" He bowed as my parents had taught him.

"The Word of the Elder will be given when Old Red comes back. But those who do not wish to see Old Red punished, Jim Jenkins?"

He stood a moment, absently scratching one hairy forearm against his hip, then answered, "The other day two of the Folk said something against the Elder, for Old Red. Tony Shelton heard. I told Tony Shelton and Paul Pomroy and Tim Marvic to beat them up. They beat them up."

"Why didn't the Elder hear of this?"

"The two didn't tell the Elder. They knew Tony Shelton heard them. They said something against the Elder."

"But why didn't *you* tell the Elder? You did wrong, Jim Jenkins. You should not beat up men like those two. You should tell the Elder."

"Yes. I hear other Folk say something the same, I tell the Elder Stevan."

I let him go without asking him the names of the two dissidents. I was more than satisfied. It couldn't have worked out better if I'd planned it. Jenkins was one of the Folk whom I could trust, and now that I could count on him and his friends to form the beginnings of a spy system I felt easier about the situation.

A spy system in the village was something new, but so was Old Red's action in leaving on a foraging party without my sanction. That was new, and unpleasant. I was alone, the only Elder, and now that the routine of obedience to the Word had been broken I was none too sure of what to expect.

I entered the information of Grace Jenkins' wedding in the Record, then stood up and slowly walked to the window. The chalky white trunks of the long-dead oak grove stood motionless between me and the night. As a child, here in the Temple, I had once thought of them as guards protecting the Elders' home; now I found myself wishing, whimsically, that each of them had at least a bow and arrows in its hand.

The foraging party returned several nights later. The first thing I noticed when the leaders of the party were brought to me was not Old Red, or Buddy Hoey, or anything connected with them. The first thing I noticed was the girl.

She was a prisoner who had been taken on the expedition. She was dressed in a cloak of animal skins of some sort, quite different from the rough woven clothes of the Villagers. But that was not the only

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difference. There was her firm-jawed oval face, with its arched brows—it took me a moment to place the nature of the difference.

She was human. She was the first human I'd seen since my father's death years before. Human—not Folk!

I addressed Old Red. "Tell of the people you found."

"To west and north, near the river. Had no houses, not much clothes, only deerskins, other skins. Had beards. Meat, but no leather, had no cows to keep. Many dogs."

"About how many people were there in the tribe?"

"Twenty, thirty, more." He frowned and shrugged. "We caught them."

"You surprised them—at night?"

"Yes. But dogs barked, they got away. They thought we were more than them, they ran away. We killed some. None of us killed. We took meat and—her." He indicated the tall, black-haired girl beside him. "Tried to take dogs. Good dogs."

Then I asked the question that was uppermost in my mind. "Were all the people like the Folk?"

"Didn't see faces of all of them."

"But of those you saw—?"

Again he nodded at the prisoner. "She was the only one like the Elders." (*Like the Elders,* I thought. *Well, he was the first to say it.*) "The others like us."

"Was she a prisoner from some other tribe?"

The girl herself answered. "I child of Chief. Name Barbi."

She was part of this Folk tribe, then. That was something to puzzle over later. But something else was brought home to me by her words. They were spoken in English, of course, but they were spoken so exactly with the intonation of the Village that I realized suddenly where the Chief and his tribe must have come from. During the time when my parents were Elders, shortly after the Folk had been taught the use of the bow and arrow, a number of Folk had left on hunting trips and never returned. They must now be the "Chief" and his men. Let's see—if this Barbi had been born soon after they left the Village, that would make her eighteen now; about right.

I put it up to Old Red. "These people may be those who left the Village in the Elder David's time. Did you see any faces of men you knew?"

Obviously the idea was new to him, for he was taken off guard and made one of his rare slips. "Yes, Elder Stevan," he said. "I thought it were the same. We punished them for going from the Elder—"

I laughed harshly. The laugh was well done. He stopped.

I questioned him further. It seemed he and Hoey really knew very little more about the tribe. For the rest, they had found few houses along the way, but there was one large cache of canned goods; they had not made many attempts at hunting; there had been considerable woodland in the territory they cov-

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ered, but mostly prairie; enough water.

My questions were over. I stared at Old Red and Buddy Hoey. Hoey dropped his eyes, preferring the sight of his unshod toes to my face. The two Folk guards and Barbi watched curiously. Except for the sputtering of one of the thick bayberry candles beside me, the room was still.

I had to name the transgressors' penalty. It couldn't be as stiff as I'd planned, because the party had been too successful; at the same time I couldn't go too easy in punishing a disobedience of the Word of the Elder. I improvised, and hoped the four Folks wouldn't notice my scanning their faces. "Until harvest next year, those of the foraging party will clean the barn." That, they would not like. "And each of them gets forty lashes; in public, next rest day. Fifty for Old Red; and Buddy Hoey." That was enough. "You did very wrong, and the forfeit is small. Another time it will be much more.

"Later this summer another party will go out, to bring back the food you discovered. It will be led by Jim Jenkins." Buddy Hoey didn't like that, either; the idea of Jenkins, the farmer, in charge of such an expedition rubbed him the wrong way. Let it rub.

One of the guards, Tim Marvic, moved as if preparing to leave, but the other told him by a nudge that I had more to say. And I had. Something as important as all the rest.

"Barbi is not any more Old Red's prisoner." As I spoke I glanced at her; she returned the look with unwavering calm. I hoped the trembling I felt didn't sound in my voice. "Nor is she any longer the prisoner of the Village. This night she is freed. She lives at the Temple, and her name is the Elder Barbi."

The two young guards turned toward each other, startled; even the imperturbable Old Red bit his lip behind his carroty beard. The girl looked alertly at them and at me, taking the situation in.

"The Word of the Elder," said Tim Marvic hoarsely.

I motioned to the guards to leave with the two raiders, and they shuffled out through the blackness of the door, leaving me with the unknown stranger who was the Elder Barbi.

"You know you are different, don't you, Barbi?"

"Different, yes. Was child of Chief, now Elder Barbi—Elder Barbi." She smiled.

"You know that's not what I meant."

"Yes."

She was sitting on the floor, restlessly I thought, in the direct sunlight from the paneless window. I watched her lazily from the Elders' chair, between its rude candelabra. Barbi's black hair shone blue-white in the sun. She shifted, sitting upright and clasping her knees in her arms, and the hair fell liquidly around her shoulders.

"How are you different? Tell me."

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"Look different. Father told me I look different, told me I look—"

"Like the Elders?"

"Don't know. Heard the word—" She stopped to frame the sentence. "I know I heard the word 'Elder' before I came here. I think my father told me that."

I mused, wondering what the results would be of my precipitate action in taking the girl into the Temple. There was one big result already—I had Barbi. That was, so far, a decidedly pleasant result.

But what I had was a half-savage Barbi, illiterate and ignorant as any of the Folk, in spite of her alertness and her obvious human intelligence. Not an Elder. She accepted completely her position and title as my wife, but she was not yet an Elder. I smiled, then wondered why.

"Barbi, did you ever ask your father why you looked different?"

"Yes."

"What did he say?"

"Didn't know. You know," she stated, turning toward me.

"Yes, partly. Shall I tell you?"

"Yes."

"Well, long ago, more than a hundred years ago, there were many more people here than there are now. They had large houses and many other things; this house and all the other large houses in the Village were built in that time. And all the people were like you and me."

"None like the Folk?"

"Not as far as I know. The books"—I waved toward the hundreds of volumes piled on the floor along the room's walls—"have many pictures of men, and none are Folk."

She jumped up, crossed in front of me, and leafed through a few of the books on top of the piles, as she had done several times before in the two days she had been at the Temple. "Yes," she said. "Father didn't say that."

"He doesn't know it. From what you've told me, your parents came from the Village, and no one in the Village knows what I'm telling you."

"Why not!"

"Only the Elders know."

She said nothing.

I took a deep breath. "You have seen the City?"

"The City?"

"Let's go and take a look at it."

I lifted myself to my feet and led the way out the back door of the Temple and up the small knoll to the east. It was hot, I realized. The sun's constant yellow speared down on the bare hill, the sun's blue hung in a haze around us. From the threshing floor far behind us, in the Village, came the sound of a new Folk singing.

I spoke as we walked. "These people long ago had many things we don't have. For instance, they had ways of killing other people much stronger than our bows and arrows. They could kill more with one blow than there are in the whole Village."

"How?"

I smiled. "Don't worry; *I* can't do it. But when people fought then,

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more would die in a single night than you can count." We had reached the top of the hill, and I was out of breath. "I'm getting old," I said, offhand.

She looked at me, aslant. "How old are you?"

"Thirty-five. Same as Buddy Hoey."

She seemed incredulous. Well, *that* was one of the things I'd have to explain, too.

I pointed ahead of us, where the hill sloped down to a broad level valley. "There's the City." I tried to speak matter-of-factly; it did no good to be bitter after a hundred years. "See that ring of peculiar brown and gray things, like rocks? They used to be houses, some much larger than the Temple. See that space in the middle, on the river, where the very green grass is? There were houses there, too, and people."

Her face showed awe, or perhaps just bafflement. Still she did not move, but stood beside me, independently.

"People died there, Barbi. And horses, and dogs, and rats, and birds . . . everything died. More people in a single night than you can count. Other places there were other cities, and everyone there died, too.

"And after that there was the radiation—you can learn from the books what that is. Those people who were still alive were poisoned, they grew weak and sick, they died in one way or another."

"Not all of them."

"I hope . . . I don't know. There may not be anyone alive anywhere except right here. Here, a strange thing happened. One of the people near the City, or perhaps more than one, were changed when the City was destroyed, so their children were Folk, and their children's children." And what a fantastic accident that had been! But there was no point in trying to get Barbi to appreciate the extent of the coincidence, or the luck it must have taken for the first Folk to survive. "The Folk were different. The radiation hurt them hardly at all. They weren't sick and weak, like all of my grandfather's people."

"But—"

"I know, you don't understand. You can learn from the books. Here's what happened. The Folk lived near the City for many years; my grandfather's people lived out behind this hill, where the Village is now. My grandfather and the rest had the sickness and were dying off; on the other hand the Folk didn't have the knowledge that the people, before, had had. Living so close to the City, the parents of the first Folk and the other survivors from before the War must not have lived long enough to teach the Folk much. I suppose all of them must have been gone within ten years; and the last of their children—those that weren't Folk—must have died within the next twenty years after that. Leaving the Folk, who knew how to open the cans of food they found in the ruins but didn't know much more. They

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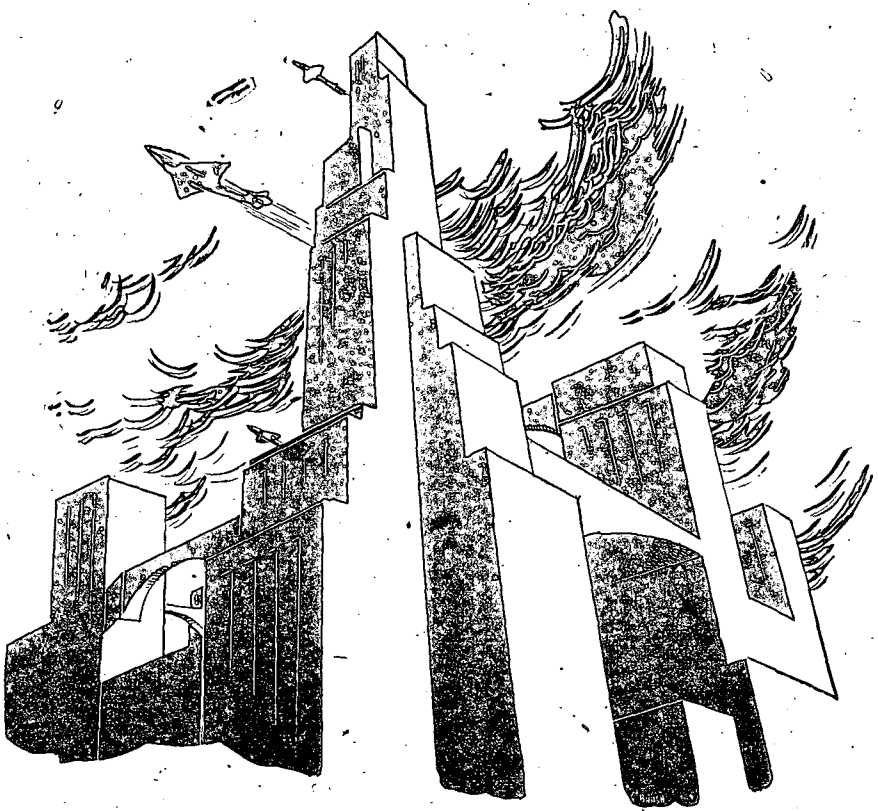
could speak hardly at all, I understand."

"Yes, and later the Folk came here and the Elders taught them and had them work on farms. You told me about that already, a little. And the Village, and the Elder David and the Elder Carmela, and you—But Stevan, what you said before isn't right. I'm not like you said. The other childs . . . the other children in the tribe never—"

She must have seen the way I was looking at her, for she broke off. In a strained voice, I said: "Let's see you run down to the Temple and back."

For just a fraction of a second she hesitated, a questioning look in her black eyes. Then she was off, and by the time I'd turned my head to follow her she was going all out. And I mean all out! "Scamper" isn't the word; "fly" isn't the word either. She simply and matter-of-factly covered ground. It was just that she covered an awful lot of it. A little way down the slope she



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stooped, hardly breaking stride, and snatched off the leather moccasins I had given her; barefoot she went faster if anything.

I walked down toward where she'd dropped the moccasins. I still stared at the distant Barbi, her long golden legs flashing in the sunlight, but my thoughts were on my older sister Beth. Beth had died, at about Barbi's present age, of a tumor—radiation again. My picture of her was of a slight, heavy-eyed girl who moved quietly about the Temple, avoiding the patches of direct sunlight from the windows. There were no clocks still operating in the Village, but I didn't need to time Barbi's dash to the Temple to draw quite a clear comparison between her and Beth. Or between her and me.

So. Either Barbi was nearly immune to radiation, like the Folk, or else her health had been spared so far by her living farther away from the City. And the second possibility didn't count for much—this long after the War, the radioactivity was pretty much universal, I was sure, though of course weaker in intensity.

I stood waiting for Barbi. She was racing uphill toward me, at the same rate she'd gone down. She was beautiful to watch, as long as I didn't think about it.

When she got to me she was smiling. Just a gentle, unassuming smile, reflecting the fact that she had made her point in the discussion. I smiled too, shaking my head ruefully, and handed her the moccasins, which she put on again without objection.

It was just as well the discussion had to wait a few moments for Barbi to catch her breath. I wanted time to think. Just at that point I was a little afraid of Barbi.

"That makes it more difficult," I remarked finally, as we stepped through the door into the sudden darkness of the Temple's interior.

"What's 'difficult'?"

"Oh . . . it means 'hard to understand', in this case. You remember what we were talking about before we went up to see the City?"

"Why we're different. But you told me why." She added, "Partly."

"What I've told you partly is why *I* am different. As for you—" I sat down, wearily; Barbi stood in front of me, arms folded. "Your parents were both Folk—unless the Chief captured you from another tribe."

"He never said that."

"No . . . I suppose he was your father, all right. You see, Barbi, the child is usually like its parents. The cattle on the plains—you have seen the high-shoulders and the short legs?"

"Yes."

"Do two short legs ever have a calf that grows as tall as a man?"

"Don't know."

"Oh. Well, it almost never happens. Sometimes the big cattle have short-leg calves. The Folk have seen them running with the herds. If you have a high-shoulder bull and cow, and know what calves their

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parents and grandparents had, you can say whether it's possible they will have short-leg calves, and you will be almost sure to be right."

"You haven't tried it."

"No."

"It's in the books."

"That's right."

"Then why don't— Oh no. The books don't say about Folk and Elders because there weren't Folk then. But there were two kinds of cattle then?"

"I don't even know whether there were or not."

"What!"

There was a frown of puzzlement on her impassive face for the first time. I laughed apologetically. How could Barbi be expected to grasp what I'd been driving at: that there were general principles of genetics? The only "general principles" she'd ever have run into would be of the sort that you don't need to state explicitly, or the sort you can state in terms of familiar objects. And here I was trying to tell her about dominant and recessive genes! About the problem of whether Folk differed from human in more than one gene; about the strong reasons for thinking it was only one; about the evidence her existence gave—the highly confusing evidence, now that she'd proved she was not altogether human.

If I'd thought a little further, I'd have realized she'd showed pretty acute intelligence, just now, in seeing that she *didn't* understand what I was driving at. I'd have been a little more afraid of her than I was.

But she was my wife, and the Elder Barbi, and I'd already decided I was going to teach her. I said: "Many things in the books are still true, even though so much is changed now. By reading them you can figure out a lot of things you couldn't otherwise."

"'Reading'—that means finding out what the books say."

"That's right. It's hard to learn how, though. Shall I teach you?"

Apparently her curiosity had been aroused by the disjointed conversation; she answered, "Yes," without hesitation.

So I began the job of teaching Barbi to read.

Not that that was the only thing I had to occupy my time that fall. After harvesting and threshing were done there was the storing of grain, seed, and silage. Later on three cows were slaughtered, at intervals, and their hides hung up to cure. The —rather tough—meat I found welcome, as did the Folk, but it reminded me again how much better it would be to have a larger herd of cattle and an adequate refrigeration system. All in good time.

When Jenkins and the other farmers would come to me to ask about the routine affairs of the Village, or to discuss the building of two new houses planned for next year, Barbi would usually put down the book she was struggling with at the time and turn to listen. She never said anything; just sat there on the floor

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beside me, her arms crossed on her raised knees, one thumb holding her place in her book, her dark eyes alert and thoughtful.

She always listened when Jenkins came alone to report in his capacity as unofficial head of the secret service. The first few times Jenkins had been visibly uncomfortable about speaking before her, but after all she was an Elder. These reports of Jenkins' were generally encouraging. I hadn't expected them to be. As a matter of fact I had rather expected it might occur to Old Red and some of the others who felt chronically cooped up and bored in the Village that the Chief had the right idea. However, none of the Folk left the Village, and Jim Jenkins reported only two or three remarks tending in this direction.

Which may have been because winter was coming on, the best season to be in the Village, or because the dissidents among the Folk had learned who not to talk to!

In any case, the dissatisfaction was still there. Wherever it was possible without losing face, I made concessions. At the same time I was more careful than ever about not losing face.

The principal concession was in allowing an Elder-sanctioned party to go out to bring back the canned goods Old Red had found previously. Among those who went were several of Old Red's adherents. At the same time I saw to it that these were outnumbered by Folk I could count on—people who would just as soon have stayed at home. The expedition was successful and caused no more friction than was to be expected; a large store of prewar canned goods was brought back and added to our winter provisions.

In the face-preserving line, I kept a Temple Guard on duty all the time, as my parents had done. The Guards chosen were Tony Shelton, Tim Marvic, and Jane Anderson. All three enjoyed the job for its prestige, and got a kick out of the rigamarole I prescribed for Villagers who came to see the Elder. It was a new game, just complicated enough not to pall quickly, and they carried it off with considerable dignity.

There was one more worry—the Chief. Old Red had routed him once, but that didn't mean much. Hunters who made their livelihood from the bow and arrow could be expected to use the weapon better than the Folk here. They were a danger. On the other hand, they had the whole continent for their hunting ground, probably with no human competition anywhere, so there wasn't too much reason for them to turn this way. I was more concerned about dangers close to home.

I remember it was in November, after the first wood-chopping parties had left, that it became definite that Barbi was pregnant. The fact seemed neither to inconvenience her nor to excite her. In fact it was only shortly after that she began to

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attack the Temple's library with remarkable single-mindedness.

Reading came astonishingly easily to her; in fact the principal hurdle seemed to be accustoming her eyes to focusing at the same distance, and such a short distance, after a life spent outdoors. From December on she got along without tutoring. The dictionary got plenty of use, but she had also a special skill for scanning a half-understood passage and extracting the meat.

By this time, of course, the Temple's glassless windows had been shuttered for the winter; so, on all but the coldest days, Barbi would save candles by reading outside. With her cloak of pieced-together rabbit pelts pulled around her and over her ears, with her feet drawn up on an edge of the cloak to keep them out of the snow, she would sit there in the lee of the house for hours, glancing up occasionally to rest her eyes, but never once coming inside to thaw out. I made no attempt to duplicate her performance.

Or else the two of us would sit and talk in the half-light of the boarded-up Temple—about her life in the tribe, about some prewar subject or other which it was hard to get from the books, or about the Village. Barbi rarely expressed an opinion, but I was more than eager to know what she was thinking, on that last subject particularly. There was just once when I got a hint.

We were in the Temple's main room, and the candles had been lighted in honor of the talk I was giving her on cell structure, which required diagrams. When I came to a stopping place, she got up and began to pace the floor.

"You've always been here and been boss?"

"Yes. Well, my parents were—"

"I know. But you were always boss after them and never did work."

"I couldn't do much work with my hands and back if I tried. Too bad, but there it is."

"Would you if you could?"

"Well—maybe not. Once the Elders were Elders, it wasn't too good an idea to be working with the others."

"Dignity of the Elders," she said, smiling a little. "Like the Lords in that book—can't soil your hands. Aristocrats."

"*Aris*tocrats," I corrected. "Yes, that's it exactly."

"You never had any wife?"

"No. My mother said it was all right, but my father told me no. Said I shouldn't have a wife from the Folk till I was sure I couldn't find one of my own race."

"If you got a Folk wife, that'd make you too much like the rest."

"That's right."

"Can't be like the rest, can't do work. Aristocrats. Different from the Chief," she added suddenly.

"Not entirely," I said. "If people hadn't been willing to obey your father, they could have got a new Chief. Somebody could have fought your father for it. But from what you've told me, nobody ever did."

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She stopped her pacing, sat down on the floor. A heavy lock of black hair fell across one cheek, shadowing her face. "You're right," she answered, turning her face up into the candlelight again. "Nobody really thought of changing things. He was a good Chief."

I leaned forward, elbows on knees. "Same with us. We're the Elders—'Elders' with a capital 'E', even though the Folk can't write—the Folk don't think of changing things. And we're good Elders. We earn our food. We know things they don't, we can figure out things they can't, we can rule them best for their own good."

"For *your* own good."

"For our good and theirs." I didn't mention how completely the Folk were left out of my mental picture of the world two hundred years from now. Better to give her the picture of myself as benevolent despot.

"Why can't they go hunting all the time the way my people—the Chief's people do?"

"It may seem to you the Folk are being held back. I suppose that's true, in a way. But how are we going to build up the civilization people had before the War if we don't have something like the Village and the Elders? Start from nothing? Without the Elders it would have taken the Folk many thousand years to get where they are now. If they all scattered in bands of hunters now, the Temple library wouldn't have anyone to read it, and people would forget the ways of getting food from wheat, vegetables, and tame cattle. The Folk would suffer in the long run from forgetting all this."

"And you'd suffer. Even if they didn't forget you'd suffer."

"That, too. But they'd forget."

"I'll think about it."

And I knew she would.

II.

Barbi's son was born in July, almost two weeks premature.

The fact that he was premature was fortunate in one way at least. It saved me a lot of worrying. As it was, the whole thing broke quite unexpectedly. Barbi announced, calmly as ever but quite positively, that things were about to happen; the Temple Guard went to the Village to fetch a midwife; the midwife retired upstairs to Barbi's bed; and I was left alone downstairs to catch up on the worrying which normally would have been begun some time before the event.

There was enough to worry about. Even objectively, this was a darned important child that was being born. And subjectively I was nervous as all get out.

I waited, in silence. After a time, there were conclusive sounds from upstairs; I still waited. Crickets shrilled through the warm night.

Finally I could go up. The midwife met me at the door of the room. "Boy, Elder Stevan." She stood aside to let me in. Barbi lay on the

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old, rusted bedstead in the corner. Her covers looked oppressive in the heat; sweat was standing on my own face. Hers was streaked, but unlined. I stroked her cheek, and she smiled—not a brave smile, but a perfectly spontaneous one; there was nothing to be brave about.

The midwife came up with the child in her arms, wrapped in a single piece of rough linen cloth. I turned to look at him.

Now any newborn child has a disconcerting similarity to a young pig; that I knew from the picture in the books, which—believe me!—I had studied. And I understand that a newborn chimp looks practically human. None the less, the distinction can be made, and you'd have to be pretty short-sighted to hesitate in making it. What's more, racial characteristics if pronounced enough, even sometimes family resemblances, can be distinguished in the walnut-wrinkled faces of the newborn. I had no difficulty at all in perceiving that Barbi's son was Folk.

Did the midwife know? Probably not. But Barbi— Well, she'd never seen a young human, but she could look at the books' pictures as well as I could. If she didn't suspect, she would, and soon.

I said nothing about it to either of them, but fought the problem out with myself.

The father—Elder Stevan—human. The mother—Elder Barbi—human. The child: Folk. High-shoulder and short leg—

All right then. There must be at least one gene in which I was distinguished from the Folk. Were there more than one?

My grandfather had thought not. Since the Folk strain had been unknown before the War, it must have originated at the time of the City's bombing, so my grandfather assumed. Now the percentage of mutations which are able to live at all is so extremely low that it's stretching probabilities too far to assume that more than one gene was changed—whether in the same or in different children. This one gene might be one which appeared in several different forms among humans, of course; but among the Folk there was only the one allele at this particular point on this particular chromosome—the mutated form.

On the other hand, my grandfather hadn't known about Barbi. Suppose there were actually two genes wherein the two races differed. Suppose Barbi had the human gene in one case—so that she looked like me—but didn't have the other human gene, which would have made her susceptible to radiation poisoning. Then consider only the first gene, in which Barbi and I agreed. Then in order for us to have a child which, as regards this gene, was Folk—let's see. The Folk gene would have to be recessive, for if it were dominant one of the parents would have to be Folk in appearance. But if the Folk gene was recessive, then both parents must be

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heterozygous! There must be Folk in my ancestry as well as in Barbi's.

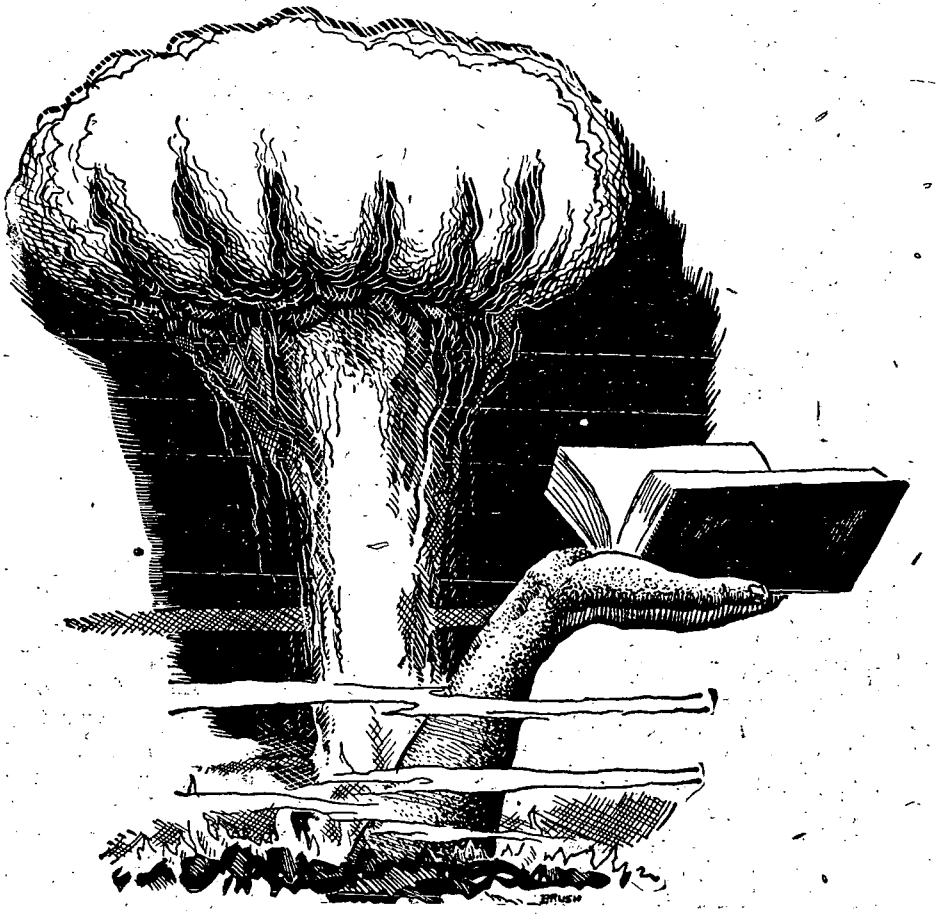
There were other difficulties in the theory, when I thought it over; but at least it held promise that our next child would probably—seventy-five percent probability—be human.

Anyhow, the theory was not true. There was another birth in the Village only a week later—Paul and Grace Pomroy had their first child, a daughter.

She was human.

I made no attempt to conceal my agitation from Jim Jenkins, the child's grandfather, when he brought me the news. "Are you sure?" I asked unsteadily.

"I saw the Elder Stevan when he was a child. Think I know—"



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"Are you sure!"

"Yes."

"Has this ever happened before, Jim Jenkins?"

His heavy pepper-and-salt eyebrows drew together in thought. It wasn't just the effort of remembering, I was sure. His answer was, "Yes, Elder Stevan."

"When?"

He bit his lip. "My sister, she named Grace, too."

"Yes, Tim Marvic's mother."

"Yes. Her second child looked like Elders. They killed it."

"What? Why didn't they tell the Elder?"

"Elder Stevan, before Elders came there were childs like that, Folk had childs like that. My grandmother told me. All childs like that died anyway, so Folk killed them. My grandmother told me.

"I told my sister shouldn't kill child, should ask Elder. She said Elder not like child that kind, Elder kill *her*. So I didn't tell Elder either."

"Hm-m-m. It was long ago, so there is no punishment, but she did very wrong. Tell her that. No killing in the Village, ever."

"I'll tell her."

"Jim Jenkins, was your sister's husband any relation to Paul Pomroy? Or to you, or to the Elder Barbi's parents?"

The lines between his heavy eyebrows deepened.

"Bring the Record," I said.

"No, I remember, Elder Stevan. Mother of Elder Barbi's father was sister of . . . sister of grandmother of Paul Pomroy."

That was enough for now. Some other time I could get a list of any other human births in the Village, and study the suddenly important genealogy of the Folk. Right now I had to see Barbi.

When I got to Barbi's room I was puffing and flushed. I sank onto a chair; she looked up from her bed and smiled.

"Barbi, two of the Folk have a child, a girl, which is—like us! You know our child is—Folk."

She feigned mild astonishment at this last. "Oh?"

"Yes," impatiently. "You can tell by pictures of human babies in the books."

"Human? My baby looks human to me."

"Humán—all right, human. But different from us."

Calmly, "Never noticed." She smiled disconcertingly.

Then, propping her head on one arm and staring at me, "Dignity of the Elders again? Yes, I see your point. Well, what did you have on your mind when you came running up here in such a hurry? It wasn't just to give me the news. No, don't tell me, I'll guess. You wanted to switch the two babies." She glared—there's no other word for it.

There was no point in admitting her guess was right. "Not exactly. I think the Pomroy girl should be brought up here, though."

"Her poor mother!"

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"Grace Pomroy can come to nurse," I added hastily, "and wean the girl soon to go back to her husband."

Pause. Barbi lay back on the bed, starting a train of groans in its decrepit joints. She said: "Why is it so important the girl comes here?"

"Barbi, the Folk are all very well now—they can live with the radiation, which none of us have been able to do except you. But against the time when the radiation dies down, we must have as large a group as possible for people like us, and we must keep the group pure." My voice died out on the last words. The idea was one I'd accepted for years, but *now*— Keep the group pure, indeed!

"You've said something like this before. Why must this be?"

"Why must we keep our group alive? Because when the radiation dies down we'll be the stronger race. We have more intelligence and initiative. We're more—"

"Maybe." The word was pronounced in an intense half-whisper which seemed to project it direct to my brain, bypassing sound. I looked at Barbi, jolted.

"Maybe," she repeated. "The books tell of many aristocrats who have thought themselves superior. Remember?"

I started to answer; she forestalled me with a lifted hand, but said nothing. We exchanged a long, ambiguous stare—which was interrupted by the baby's waking.

Barbi sat up quickly, with a little laugh, and I left. But the conversation had not been finished. I finished it with myself as I walked slowly down the stairs.

Yes. The aristocrat had denied the slave education, and called him stupid; had given him routine jobs with no hope of advancement, and called him lazy; had refused him his share in civilization, and called him a savage. All without justification. Barbi was right.

But surely the Folk were different from me, less intelligent, less— I could hear Barbi's answer: *Maybe.*

As I'd suggested, Grace Pomroy came to the Temple with her girl, Terry. Barbi accepted the idea, accepted it cheerfully in fact. When the babies slept, Barbi and Grace would take turns keeping an ear on them; when the babies were awake, they'd take care of them together. It was hardly any time at all before the two women were like sisters. This situation may have bothered Grace a little; to me it was definitely disquieting.

My peace of mind during those weeks was practically nonexistent anyhow. Jim Jenkins came to the Temple often—too often—and it wasn't just to see his daughter and grandchild. I did not enjoy the things he had to tell me. First, there were the jokes circulating among the Folk about Fritz and Terry. I found these stories anything but amusing, but what could I do?

Then there was Paul Pomroy's re-

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quest, apologetically forwarded to me by Jenkins. Pomroy didn't like Terry's staying at the Temple; she was his girl and he wanted to keep her. I wondered: Had someone put him up to this? Hard to guess. My answer was obvious—no.

These things were just the minor symptoms of dislocation. Pomroy's Terry and our Fritz—two still-unexplained mysteries of genetics; they were causing a lot of trouble, considering that neither had reached the age of one month.

They weren't causing *all* the trouble, though. Jenkins reported several times that various Villagers were discussing leaving the Village. Summer had come around again, and here it was again, the problem of Folk who thought hunting would be a better living than sweating on the farms. Well— I appealed to Jenkins. "How many want to go?"

The familiar half-frown. "Twenty, thirty."

"How many are you sure you can trust? How many will do whatever the Elder says?"

The frown deepened. "Twenty, thirty."

That was a shock, and not just because thirty plus thirty failed to add to the population of the Village. I called in the Temple Guard, Tony Shelton, and got about the same answer from him.

There it was. I couldn't afford a showdown, because all Old Red's men had to do was clear out, head for the hills, and I would have lost! The Village had to be held together. As for keeping the dissidents here as prisoners, that would require more loyal supporters than I had, and even if it could be carried off it might be merely postponing the issue. I'd lost too much face recently to try appealing to Word-of-the-Elder hocus pocus; which about exhausted the possible courses of action.

"Jim Jenkins," I said the next time he appeared, "can you say things so the Folk will think the Elder will let them go hunting? Not say you *know* what the Elder will do, but make the Folk *think*—"

"Yes, Elder Stevan."

It was the best I could do. If I couldn't prevent the group from leaving, I'd have to persuade them to allow their leaving to be sanctioned! That was the only way there was a good chance of their coming back. Still, even if they did leave with permission, there was a good chance they'd go the way the Chief had gone. Maybe, I thought, the party when it goes should be loaded with loyal Folk. Even with that idea, though, there were all sorts of difficulties. There might be fighting in the party once it got out of the Elder's shadow; the ringers I included might find they liked farming less once they'd had a taste of something different—

I *said* my mind wasn't exactly at ease.

The answer to this particular problem was simple, although I would never have thought of it. It was Barbi who made the suggestion:

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A foraging party should go out, and *she* should accompany it. I was startled by the idea of her going off and leaving Fritz, but she assured me that the women of the Chief's tribe frequently took part in long treks carrying their infant children on their backs; she would take Fritz with her. And really, the plan was perfect. If anybody could keep Old Red and the others in line it was Barbi: she knew as much about hunting and camping as any of them; and, to go with that, she had the name of Elder and as much prestige as still went with the title.

I agreed to the plan quickly. Two days later the party left, with Fritz incredibly asleep in the linen pouch on his mother's back; and that night I slept peacefully again.

It was not new to me, sitting alone, weak and inactive, sitting in the Temple with the problems of the farms and with my books. It had never bothered me before. Perhaps now it was the thought of my wife and son out there to the west with the foragers which gradually made me restive. *They* were not weak. They were where the adventure was. They could live under the sky while I was imprisoned here by my own feebleness.

It was this very mood of discouragement which led me to an adventure of my own. The phenomenon of Fritz's Folk-ness recurred to me oftener and oftener, until finally it reminded me of a long-forgotten fact which had never held any great interest to me, but which suddenly offered hope of an explanation. What was the book? Babcock and Clausen's "Genetics for Students of Agriculture." It turned up near the bottom of a heavy pile in a corner of the main room; in my impatience I worried it out of the stack myself, rather than wait to call Grace, who could have done it easily. And after a session of leafing through the dried, brown-edged pages I had what I wanted.

The term was "incomplete penetrance"; the way it works is this. Suppose you have a dominant and a corresponding recessive gene, call them A and B—say, high-shoulder and short-leg cattle. Then an individual having one A paired with a B will have the characteristics that go with the A—almost always. Purebred high-shoulder bull and purebred short-leg cow will have calves resembling the father—almost always. It's that "almost" which I'd only now remembered. The recessive characteristics *can* show up. A hybrid bull *might*, for example, stand as tall as the high-shoulders but have the down-turned horns of the short leg.

Whether that particular type of bull ever lived, I didn't know. But I thought I knew rather intimately a much more important example of incomplete penetrance.

Barbi.

I ran rapidly over the other theories which had occurred to me. There was, I verified, some fatal weakness in each of them. I was

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left with this new theory, which checked perfectly.

The Folk strain—the mutant strain—had to be dominant. Dominant mutations are rare, but the conclusion was inescapable. The Folk gene—and one mutant gene was all I had to suppose existed—was the A, the corresponding "normal" gene was the B.

The first Folk would have had to mate with one of the City's few human survivors; so originally the Village's ancestors would have been at least half human. A good many of the children in each generation would have been BB; but those paired human genes would have meant human characteristics and, in the radiation-drenched City, an early death. After awhile, the Folk killed human children at birth, by custom, so Jenkins had told me.

Still, the AB type could survive, being no more radiation-susceptible than the AA, the pure-bred Folk. And sometimes a child of two AB's could be—well, could be like little Terry, who already showed symptoms of feebleness dangerously like my own.

Then Grace and Paul Pomroy must have the same geno type, AB; as did my son. Barbi, too, was AB, but she was the anomaly, incomplete penetrance. She showed some characteristics of the recessive human strain she carried. But in the matter of resistance to radiation she ran true to form.

Genetically, my wife and son were as much Folk as Grace Pomroy. What was it I'd said to Barbi? "We must keep the group pure." A praiseworthy project indeed, I thought bitterly.

The morning after Barbi's return I awoke before dawn. Outside, rain was falling, the slow rain we get sometimes at night—but never by day in summer. I could hear the small sound of the water running down the valley in the roof; immediately above me there was a steady drip on the attic floor; around these intimate noises there was the hushed murmur of the sodden grass. It would have been pleasant to forget everything but the statistical patter of the rain, and go back to sleep.

But whatever had waked me kept me awake. What was it? Not the rain. Some night sound—some thought that had recurred to me in my sleep.

Getting up, I pulled my coat around me and crossed to the window. And suddenly I knew what had been on my mind.

The Chief. Before the foraging party's return, Tony Shelton had seen outside the Village two men with deer skins across their shoulders—a costume unknown among the Folk here. Yet Barbi's party had not reported meeting the Chief, or seeing any sign of his camp sites. Strange, to say the least.

Barbi's whole account of the expedition, after we got back to the Temple, had been strange. She was far more articulate than Old Red, yet her account was hardly less

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sketchy than his would have been. I questioned her, and she answered openly enough; but most of the answers were negative and all were just the minimum required. There was no complaint I could make—but the thing puzzled me.

Then I told her of the discovery I'd made while she was away. She listened calmly, and when I was done she lighted a few extra candles, got the genetics book out, and read over the passages I showed her.

At the end, she looked up and smiled. "Good work," she said. "'Incomplete penetrance.' Nice phrase.

"Now," she went on, "what does this mean for the Elders?"

"Go on," I said, on my guard.

"All right. In the first place, there won't be any keeping the line of the Elders pure. Any children we have later will be likely to be like Fritz. Fifty percent probability, to be exact. And then—what are the probabilities for 'human' births among the Folk, do you think?"

"Two percent," I hazarded.

"Two percent—all of that. There's one consolation for you, Stevan. Even if the direct line of Elders dies out, the 'human strain' you worry about will still be around."

"Among the Folk."

"Yes."

I stood and began walking nervously about the room. "That doesn't console me much. There's something in one of the books about population sizes. The smaller a population is, the more likely it is for a strain to die out completely among the population—just by accident. Maybe it just so happens that all the AB-type Folk are out on a hunting party that gets trampled by a herd of cattle. Maybe something less spectacular. There's no safety except in numbers; if the Village were a hundred times as large as it is, the human strain would be reasonably sure of surviving, even if it wasn't present in any greater proportion than it is."

"I see, yes. And beside that—"

"Beside that, it's *not random*." I crossed in front of her. It was funny for me to be pacing the floor while she sat there, relaxed. "The BB's—the human proper— wouldn't have an even chance of survival, not for another hundred years. They'd be sickly—"

"That's true. And your strain absolutely must be given a chance, mustn't it?"

Now, standing at the window and staring at the gray oak trunks against the blank darkness, I mulled over that last question. A threat? Or just a taunt? I didn't like it. And there had been plenty on Barbi's mind that night that I hadn't been let in on.

A new sound cut through the monotonous sluicing of the rain water. Though I couldn't identify it exactly, it told me Barbi was awake. I stood rigidly in the solid silence.

Behind me, "Can't sleep, Stevan?"

"No; no. I just woke up."

"Worried?"

"About what?"

"You should be worried, Stevan."

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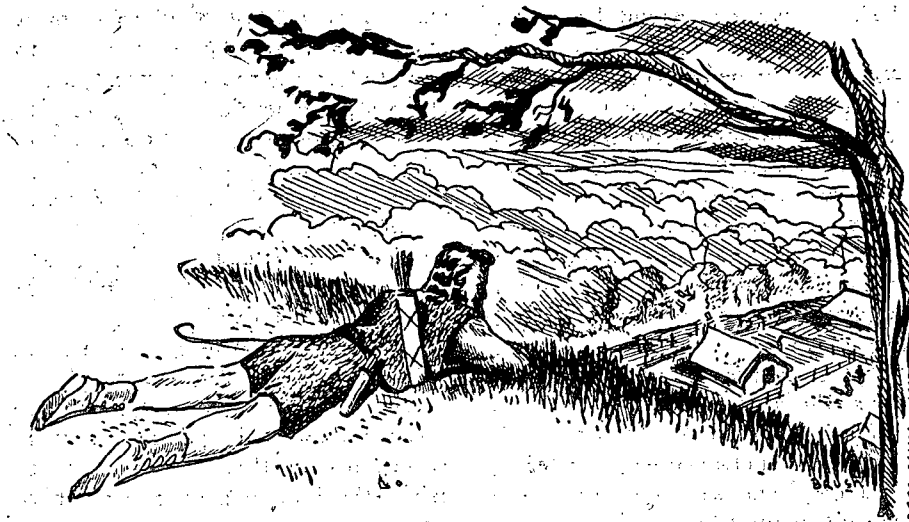

"Oh?"

"I wasn't going to talk to you about it again, but I will. Stevan, you haven't got the right answer."

"What do you mean?" But I thought I knew.

"Let's see what your excuses are for this 'Elder' business." I swallowed hard, stood stockstill at the window. Her voice came clear and brisk from the shadows behind me and fell weirdly on my tired brain. "You want to save time, right? You don't want civilization to have to start at the beginning again, you want to save time by keeping hold of the knowledge from before the War. But this isn't the way to do it—keeping the Folk here as your slaves."

Weakly, "The Folk aren't slaves."

"Some of them want to stay here," she conceded. "But some of those would be dissatisfied if they thought they had alternatives. Look. You know what a civilized world's like, you want to see one built. Well, if it's done it'll be done by the people. You can't just decide what it'd be nice to have happen. The men who are going to do it have to *want* to do it."

Her earnestness frightened me; so I tried to sound amused and academic. "You seem pretty confident of your theory of history."

That stopped her. She'd learned a lot in the last year, but she realized how much there was she didn't know. "O. K.," she said, "I'll be specific. You might like the idea of a race of farmers, sticking peacefully to one place. But if there's an easy living to be made by hunting, somebody's going to take to the idea. If there's an easy living to be made by raiding villages, somebody'll take to that, too. Your books won't stop them."

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"You're worried about the Chief, too."

"No," I turned at that, but she was in darkness and I couldn't see her face. "I'm not worried, I just admit he exists. You don't, so you can't have the right answer."

An abrupt weakness came over me. My limbs felt as if they were loose in their sockets. I clutched at the window frame, half surprised that my hands would still move. "Yes," I brought out, "I've got the *only* answer."

"I think not, Stevan."

My head fell forward. The red lightning erased everything then; it did not stop when I shut my eyes.

Barbi was watching me. Holding my breath and balancing carefully, I made it back to the bed without falling.

III.

"Elder Stevan."

The voice was gentle, but insistent. "Elder Stevan," it repeated. There was an urgency in it which carried it through to my sleep-drugged consciousness. I rolled over and sat up.

The first thing I noticed was that the first trace of light was just now showing in the sky. Then, that Barbi was not in the room.

The next thing was that Jim Jenkins was at the door. Seeing that I was aware of him, he spoke. "My daughter is at my house. Grace Pomroy. She has the two childs with her. Paul Pomroy isn't anywhere; can't find him."

"Well?"

"Grace has brought the two childs from the Temple to my house."

The strangeness of the report hit me then. "What? Why did she do that?"

"She says the Elder Barbi told her to do it, told her not to tell anybody, but I saw her there and—"

"Yes." I rose, passed Jenkins, and call from the door, "Barbi!"

The echo spent itself. There was no one in the Temple.

"You came here, in this part of the Temple where the Folk do not go, and just to tell me— Well, you did right," I decided, keeping my voice carefully under control. "Do you know where the Elder Barbi is?"

"No."

We started downstairs, Jenkins trailing. "Do you know of anything else unusual's happening, Jim Jenkins?"

His answer was negative, but a positive answer arrived soon enough.

We made our way into the great unlighted cavern that was the Temple's main room. Jenkins was still in the process of lighting candles when we heard footsteps outside, someone running. Tim Marvic, the Guard, called, "Tony Shelton would see the Elder."

"Enter, Tony Shelton."

He burst in, followed by an identical shadow on the book-lined wall. "Elder Stevan . . . oh, Jim Jenkins."

Jenkins nodded, lighted another candle.

After a moment's pause to catch

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his breath, Shelton announced explosively: "Lookouts saw men at five different places. To south, and over hill toward river, and off there to west. Not men of Village. All five seen just now, this night."

"So soon," I said, sinking into a chair.

The Chief! It might be no coincidence he came now; he could have seen Barbi's party, followed it here. No, not that, he wouldn't have needed the expedition to lead him to the Village, for he had been born here. *Was* it coincidence, then?

"Coincidence, heck!" I said to myself angrily. Everything pointed to one simple and unpleasant explanation, and I might as well face it. Jim Jenkins' spy system had failed completely. That expedition to the west had been a council of war with the Chief, against me, and neither Jenkins nor I had realized it.

But *why?* Why would Barbi do it?

"Elder Stevan." Shelton had more to report. "All gone from Buddy Hoey's house. No one there."

That clinched it. I said rapidly: "There may be a fight. The Chief hasn't surrounded the Village without a reason. Just the same, we shouldn't start sending arrows after the first of the Chief's men we see. If there is a fight, it will be because they start it."

"Yes, Elder Stevan."

"We aren't sure how many of the Folk will be with us. Do you have any idea, Jim Jenkins?"

Jenkins was conscious of his recent failure, and didn't offer a guess. Shelton said: "Twenty, more." That might mean almost anything; I wasn't sure how far Shelton could count.

For a long half-minute I sat desperately trying to think what to say next, realizing that I wasn't completely awake yet. "Tony Shelton, how many lookouts are there now?"

"Six."

"Good. Bring them all here to the Temple . . . no, send one of them to Marvic's house and houses near there, to wake the Folk. Jim Jenkins, you get the Folk in the rest of the Village. Have them bring bows and arrows."

"All come to the Temple?"

"Yes."

"But then the Chief—" Jenkins floundered, and Shelton took over. "Chief can take food, all things from the Village. We're at the Temple then we can't stop him."

"Yes—" But there was Barbi. Barbi was almost certainly among the attackers. Without knowing why, I was quite sure there would be a fight at the Temple," I repeated. "Go now, and, Jim Jenkins, take Tim Marvic with you."

"No Temple Guard?"

"No, don't leave any Temple Guard. You have to hurry."

So the three of them went; I watched their gray shirts flickering away into the darkness.

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The instant I was left alone I realized guiltily that the candles should never have been lighted. I put them out at once before returning to my chair. It was too late to do any good, of course. The enemy, if there was an enemy, would have seen the lights before now, and deduced that the Village was preparing.

If there was an enemy! What were Barbi's motives, after all? She had spoken earlier this same night about letting the Folk leave the Village as hunters. Maybe that was it. Maybe there would be no fight; Barbi would simply carry off a prearranged plan to smuggle Old Red's partisans off to the Chief's tribe, where they'd feel more at home.

But Barbi had also spoken of allowing the Folk to raid the Village. Sometimes her present sophistication made me forget that the first eighteen years of her life had been lived in near-savagery.

So, while the night slowly thinned outside the windows, I sat there, wide awake now, staring at the high ceiling, where the shadows still hung black as midnight. It was some time before it occurred to me that my life was in danger.

Immediate danger! I got to my feet with a start. I was alone here, and if the Temple should be attacked *now* I was defenseless.

No, not quite. With a surge of relief I remembered the rifles. There had been quite a number of the venerable weapons here in my grandfather's time. When the Folk had come and it became clear they could not be fought off, my grandfather had buried all the remaining ammunition, assuring the Folk there was none left and the rifles were useless. I knew where the ammunition was hidden, and the rifles were in the cabinet in the kitchen. I smiled gleefully to myself. Not many prewar battles had been won by secret weapons, but the battle coming up now might be.

As I was crossing the room to the kitchen door I heard footsteps outside. I hesitated. If these were not friends, nothing would help now. I reversed my steps, opened the front door. They were friends.

Tim Marvic, Jane Anderson, and about twenty others burst chaotically into the Temple, breathing hard from the haste of their coming. Then, as abruptly, their motion stopped and they stood bewildered in the darkness.

I gave rapid instructions. The windows of the Temple had to be boarded up, leaving only a narrow slit at the side of each, through which a bowman could fire. The job had to be done in darkness. The boards ordinarily used for covering the windows in winter could be trimmed to size for the purpose; they were already fitted with dowel-holes. I would help the Folk match the shutters to the windows—quite a necessary job, in order that the dowel-holes come in alignment. I'd have given a lot for a hundred prewar nails!

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So everyone fell to work. I said nothing about the hidden cartridges. They had been kept secret from the Folk for excellent reasons, and I didn't plan to use them as long as there was a chance of winning without them.

Shortly afterward, Tony Shelton and the lookouts arrived, and on their heels the group from the southern part of the Village. Where was Jenkins? Well, there was no time to worry about it. When the windows on the ground floor had been boarded up I stationed a line of bowmen at each slit, with instructions that in case of a charge on the Temple the first in line should loose an arrow quickly and drop out of the way of the second. I took the new arrivals upstairs to take care of barricading the windows there.

I was standing at a window on the west side of the Temple when Shelton whispered over my shoulder, "Look! Men leave Lavery's house. Two I saw."

"I missed it."

"On this side."

"Jenkins and the rest must have stayed there because they thought it was too dangerous to come on to the Temple. If you saw two leave, they're probably all leaving."

"Yes."

Then I saw the reason.

At first it was only one of the windows gleaming redly. It stared for a moment, as if the flames had been frozen in place. Then a stream of fire spilled out and poured up the roof of the house.

"They use fire," said Shelton quietly.

Between us and the blaze ran a silhouetted man with his stubby shadow. At this distance he was tiny; even in the firelight he'd have been invisible except that he moved. Astonishingly, he ran all the way across into darkness without falling. When he had passed, two more followed, then there were only the flames; it was as if there were no one left in the Village to care about the loss of the house. The fire unfolded out of the window and leisurely spread its orange palm over the roof.

"We'll be safe from that in the Temple," I said, "because we can keep watch on all four sides."

"Except—"

"Except that Jenkins' men may not make it here. Tony Shelton, you'd better take ten men out and hide in the corn at the bottom of the hill on this side of the Temple—to cover Jenkins when he comes."

Shelton left. Moments later, he and his men were scattered down the gray hillside, filtering between the gaunt tree trunks as unobtrusively as smoke. When one reached the edge of the corn, he would drop to the ground and disappear. Once there was a sudden commotion in the corn, over toward the right, and out of it erupted two men, locked together, struggling grimly. The fight was terrible, but brief. A third figure rose out of the ground

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beside them and grasped a head in both arms, savagely; at once all three figures dropped into the sea of corn and there was only the burning house off in the distance to remind my eyes of danger.

So some of the rebels *were* hiding around the Temple. Yet they hadn't attacked; perhaps they would when Jenkins got here.

I started downstairs. Before I'd reached the main room I heard a suppressed shout from the bowmen at the windows there. I hurried in.

"Men by the threshing floor, Elder Stevan," a woman said. "Running this way."

"The Chief's men?"

"Yes. Chase the Folk." She didn't sound too certain of this; I looked out. There were two groups. The more distant was running in a body; the nearer—now fairly close—was dispersed, zigzagging to avoid arrows from behind. Although the dawn was coming faster now, it was impossible to make out faces; still the woman's guess was obviously right.

The nearer group reached the cornfield. Now, I thought, they would be ambushed by the rebels hiding down there, and the killing would begin. I waited; and it didn't! The men raced up the rows of corn. There was an occasional, quickly-ended scuffle, and then Jenkins' and Shelton's men scampered up through the oak grove to the Temple.

As far as I knew, not a single arrow had left its bow. It had been too simple.

It had been too simple.

A crowd of the Folk stood in the center of the main room, bewildered, panting from their run. The lines of the bowmen at the windows fidgeted. No one knew what came next.

The Folk were a crowd of shadows against the timid grayness of the windows. I picked my way among them, searching their faces. Finally I found the Temple Guards, Shelton and Marvic, squatting in the pitch blackness under the stairs. Shelton had a dark bruise, five inches long and the width of a thumb, running from his ear down across his throat.

I crouched beside them, and they greeted me quietly. "How did you get the bruise, Tony Shelton?" I asked.

"Out there, when I first went into the corn. Man right near me, hiding; I stopped. He knew I saw him, so we fought." He gripped his bow more tightly.

"I saw it, but I didn't know it was you."

"Did you see the other's face?"

"No."

"Paul Pomroy. I think his neck's broke." Shelton and Marvic both looked me squarely in the face. Less than a year before Pomroy had been their best friend.

"Others will be killed, too," I said. "Too many. It is not good."

They relaxed. That was what they'd wanted to hear, though they wouldn't have said it themselves.

"All these people here," I said,

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"they must be ready to fight. When the Chief charges—"

"Yes," said Shelton, "but maybe the Chief doesn't charge. He can keep his men all around the Temple. We don't have food. He can wait to charge."

"That's true," I answered thoughtfully, appalled that I had never thought of a siege. "Do you think he'll do that?"

"Don't know."

I stood up, glanced out the nearest window. "It's getting lighter. If he does charge, he'll have to do it right away."

We waited, and the rest of the room waited.

Now and then the enemy would be sighted—always beyond bowshot, and always only a small group. One of the watchers at the windows would report the fact, calmly. Very calmly.

"It's getting pretty light outside for them to charge," I said. Then I thought: Why had the Chief not attacked earlier in the night? Why had Jenkins' men been allowed to reach the Temple? Why had the enemy's only offensive action been to force the Folk in Lavery's house to leave it for the Temple? Barbi was with the other side, I was sure, and while she'd have difficulty giving orders to the Chief and Old Red she might have got them to accept her plan. And Barbi would have thought of a siege.

There was only one answer.

"After you've fired," I said rapidly to the small group around me, pull back this knob and flip it to the side. The next round—the next cartridge goes in here, and then you go through the same thing again." I handed the rifle to Shelton; he went through the procedure and passed the weapon on to the others. "Remember, you don't have to aim above your target; I've fixed the sights so you just look straight down them, the way I told you."

I left them to discuss it among themselves, and crossed to where the lone semiautomatic was lying. It was too bad we hadn't been able to clean the guns better after their long interment. Too bad the ammunition, which was supposed to be used within five years of manufacture, was going to be used after a hundred plus years, and too bad there were only four guns for which there was any ammunition at all. Too bad also that I was going to use the semiauto, which would have fared better by the stronger, sharper-eyed Shelton; but it was easier and quicker to do the job myself than to go through explaining another loading and firing procedure. I sighed, reread a page of the manual I'd been referring to, and slammed the book shut.

The riflemen followed me upstairs. We looked in turn from each of the attic windows, picking out the enemy in the fields around the hill—beyond range, they thought. It wasn't too far before sunrise now, and you could see them clearly. I recognized a few.

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The four of us who were armed chose our targets and took up our stations, each of us with an attendant carrying ammunition. I had the south side, where targets were most numerous. Closest was a campfire, with five men beside it, apparently asleep. It lay in a cleared space in a wheat field. What they were burning I couldn't guess. For that matter, why had they started the campfire at all?

Farther from me two groups were sitting or squatting, staring this way; also I was quite sure Marvic's house was occupied, and not by friends.

"Ready!" I called. From the other rooms came acknowledging echoes. I reminded the bowmen to stand by too, then raised my rifle and yelled, "Go to it!" And fired.

The shock almost knocked me over. It can't have been only the kick. As much as that, it was the shattering noise. I took a step backward; my hearing cleared.

The others' shots were a slow, irregular crackling. I tried again. No, the kick wasn't so bad, but the gun was heavier than I'd realized. I got a chair, experimented till I found a comfortable position; then began in earnest.

In the directionless light of dawn, a group of men crouching in a lane between fields of wheat. Only their heads were visible to me; but their bodies, though hidden, were better targets. I aimed low. Two of the men had jumped up at the first shot, but I stuck to the stationary targets. I fired more rapidly, getting the feel of the weapon. My whole body shuddered in phase with the explosions. The sights seemed to be set wrong; I raised the barrel a little. Three of the targets fell. I shifted to the others, now running toward Marvic's house. Shock! Shock! against my shoulder. Got one of them.

As I inserted a new clip of ammunition the stock trembled against my hand, silence poured shouting into my ears. Raised the barrel again, blink away the green dizziness.

Death, my brain reminded me. Blink that away, too. This wasn't killing. This was a contest against the weakness in my left forearm, the wrenching ache in all my ribs. Besides, *we had to win.*

Sweep the barrel to follow the running men, my elbow pivoting on the bruise on my knee. Rake the walls of Marvic's house. Shock! Shock! Viselike around my chest—

A figure darted from the house. Even as I sighted on it, I was suddenly filled with *joy,* the foreign irrelevant joy of remembering what came before the rifle and the shooting. The target was Barbi. I pulled the trigger—once, before I stopped myself.

I sat back then in a cool haze of relief; for now I had to stop shooting. The jolting agony could stop for a moment.

I didn't know whether I'd hit Barbi or not.

The voice was Shelton's: "You

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got many."

"Yes." I opened my eyes. "You through shooting?"

"Bruise here hurt too much." He fingered his throat carefully. "Jane Anderson took my place." He was behind me, peering over my shoulder through the window slit. "Look, Elder Stevan," he interjected now, "the men by the fire."

"I can't see, this powder smoke gets in my eyes— Oh! They're burning their arrows."

"Not burning—"

"No! They're lighting them, going to shoot them at the Temple." To send it the way of Lavery's house. The Temple! They couldn't get close enough to set a torch to it, so they were using burning arrows. The Chief had a secret weapon to match ours.

"Stop them—"

Before I had my aim the first of the arrows had left the bow. I dropped the archer immediately. The others knew better than to stand up as he had. They fired lying flat on

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their backs; not easy targets. The rifle jumped in my hands as I swung the sights in an arc around the campfire. Still the bowmen's needles drew the threads of scarlet flame across the sky, toward the Temple.

Shelton: "They hit! They hit!"

"What?"

"Arrow on the roof!"

Desperately, "How do you know?"

"I heard, right above us."

"Shelton, get . . . no, get water . . . get rugs, get many Folk to help."

"Rugs?"

Shock! Shock! And, "Yes, cover flames with them—dip rugs in water first—" but he was gone.

I had to stop to reload. I looked up at the bare boards of the slanting ceiling. No charred boards, no sign—yet. Had the arrow put itself out as it hit? The room might still be damp from the rain, mightn't it?

From the next room, "Fire! Look, there, fire!"

Before I knew it I had run to the source of the shouting. But it was not what I'd feared. At one of the room's two windows Jane Anderson stood calmly, rifle raised. At the other was a cluster of Folk, jostling, staring out. "Elder Stevan, another campfire out there."

From which would come more of the deadly arrows.

The dizziness again. Back to my own window, into my chair. The dizziness again.

I look around me helplessly, and my eyes can't quite focus on the bright mouth that has opened in the ceiling over me. The slitted mouth of red and black, widening into a yellow grin.

The sound of my horror is a shrill screaming. Not from me. Maybe not from me. But a terrible screaming, like the powder smell which scalds my lungs.

Take aim again out the window. Can't make out— Why, that's not the campfire, that's the Temple burning. Of course not, it's the campfire. The screaming goes on. My finger keeps pressing the trigger, but I don't think about my aim. Nor about the Folk scrambling about behind me, beating at the flames. Nor about the flames themselves. I think about the screaming. It's shrill and loud, but it's distant. Sometimes there are words to it; can't make them out.

What is the voice saying!

This is important, I must know what it is saying, this terrified voice—of Barbi screaming.

Hands took the rifle from me and carried me through a wave of flames.

Before I opened my eyes I felt the grass under me and the warm sun on my face. That was strange, but it didn't matter because the voice wasn't screaming any more, it was quiet, and it was saying, "Stevan? Are you awake?"

"I'm awake."

"Good. I hope you're all right. We didn't know what was wrong with you. I have to talk to you, Stevan."

I intended to speak, but Barbi began at once on an account of the

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battle. Most of this I only half-heard, for it was at this point that I opened my eyes and discovered that I couldn't see.

I blinked hard and rolled my head to one side and the other, with very little effect. It must be hemorrhages in my retina, I thought, from the jolting that semiauto gave me; but even a sure explanation wouldn't have comforted me!

The unseen Barbi was still reciting her reckoning of the dead and wounded. I forced myself to listen. When she was done I said, on impulse: "So the Chief takes over. This is what you had in mind ever since you came here, isn't it?"

"What!"

"You've just been waiting your chance to let the Chief into the Village."

"No. You know me better than to think that. When I first came, maybe—but I can hardly remember the way I thought then. I don't think the same now. Know what I mean?"

"I suppose so. I'm sorry, Barbi." I sat up, and as I did so the blood drained from my head and I shouted: "I can see!"

"You can—?"

"When I first opened my eyes I was blind. I can see again now." I exulted in the sight of Barbi standing in the grass in front of me, her feet spread and her hands on her hips.

"That's not good," she said. "You'll have to take it easy for a couple of days till your eyes heal."

"You're not going to kill me, then."

"No, I think you still don't understand what's happened."

"Maybe not. What do you have to show for all this bloodshed? Shelton and Jenkins didn't like the idea of Pomroy's dying, and they won't forget easily."

Sitting down beside me, she plucked a blade of grass and put its stem in her mouth. "In the first place, let's admit that the Village was sure to be attacked, and defeated—maybe not for several generations, but eventually."

"Possibly."

"Certainly. The hunters, with the whole continent to expand into, would multiply indefinitely. They'd have recruits from Old Red and his kind, who'd bring them any new weapons the farmers might have. That's one thing you refused to recognize—this had to happen."

"So you precipitated it, instead—"

"Now hold on. By having our . . . our barbarian invasion now, with me leading it, we get several advantages: The hunters come while there's only one weak tribe of them. Also, they come under leaders who know the value of the Village. They may loot, but they leave the Village standing, because they learn what the Village is good for leather, woven cloth, corn, and so forth. This way the Village can continue. The people here, and later in other settlements, will have the highest technology; the hunters may take the golden eggs,

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but they won't kill the goose. Civilization *will* be rebuilt, Stevan."

"Why didn't you discuss this with me?"

"I did, enough to know you'd never agree! Besides, you had to stop being God." She chewed on her stalk of grass. "I hope you don't think the Folk *liked* asking the Word of the Elder every time they turned around. Why do you think Paul Pomroy was on my side last night? Oh, you'd have had a revolt on your hands eventually, if the hunters didn't raze the Village first. Your 'Elder' religion wouldn't have fooled the Folk forever."

"I had to try to hang on, to save the books."

"Yes, yes! But what's happened was the only thing that *could* save the books. I didn't order those bowmen to set fire to the Temple, you know—"

"The screaming—"

"Oh, yes, before. I was shouting to the Chief's men to stop the fighting so we could put the fire out. It was close."

I looked up at the Temple. It was as if a great bite had been taken out of it; most of the top story was black and open to the sky. But the ground floor, where the books were, still stood.

"Yes," Barbi went on, "we have to keep the books; and the scholars. If the Elders had stayed set apart, learning might have died with the last of them. But now, we can try something else.

"You Elders studied history. You patterned your Village after what you read—a Neolithic town, with yourselves as Shamen; or a feudal manor, with yourselves as lords. Let's take another chapter in the history books. Remember? *In ancient Rome, the teachers were slaves.*"

She rose and stood facing me, smiling. "You see how perfect it is? Some people will always want to be scholars; it's an interesting and useful job. But the stigma attached to it will prevent the scholars from setting up an aristocracy, Elder-style, and that's the big danger in the weird situation the world's in now.

"I think all the 'humans' will be scholars, at first, because they're not good for anything else. And that fits, too Why shouldn't they be slaves? Such weaklings! Obviously inferior." Again she smiled.

"The teachers are slaves—"

The mighty were fallen. I had lost my kingdom, I had lost my wife; I was a sick man, incurable; now I was a slave. But around me on all sides lay the farms, aswarm with Folk, the freed Folk, and before me Barbi stood strong and confident in the sunlight.

I looked down, tried to think. It was no use. I couldn't concentrate on what she'd said. Barbi had won, the thing was over with—what good did thinking do?

"You're right," I said, quietly. And wondered if she was.

THE END.

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PRODUCTION TEST

BY RAYMOND F. JONES

This is a story about a spacesuit—a fine, practical discussion of the impracticability of mere theoretical checks on how things ought to work!

Illustrated by Orban

Bryan Kimberly looked with satisfaction at the two-page, four-color advertisement in the magazine on his desk. He leaned back in his chair to get a better perspective. A beautiful piece of art work, the illustration showed a bulbous suited spaceman halfway inside the main tube of one of the ponderous lunar freights. The dazzling streamers of light from his torch illumined the black bore of the tube, to which he was applying an emergency reline patch.

All this against the platinum Moonscape and the black night of space above. Beside the workman stood two companions, watching.

That was nice the way they were arranged, Kimberly thought. One showed the front of the spacesuit; the other gave a clear view of the rear, showing the minimum of equipment which the wearer was required to support.

Blazoned across the bottom of the picture, like a rocket trail going up, was the caption: "Only in a Kimberly can you do this!"

Bryan Kimberly settled deeper in the chair to read contentedly. "Since the first thrust-jet reached escape velocity, Kimberly has meant—freedom! Freedom to leave the prison of the ships that carry men across space, freedom to make the Moon's surface as familiar as our own home towns. Kimberly is the suit that has made the animal, man, adaptable to an environment for which he was never meant. The first human footprint upon the lunar surface was made in a Kimberly. Since then, nearly twenty thousand of these superb spacesuits have carried the pio-

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neers of a new age into the realms of the stars.

"Now, we announce a new and improved Kimberly suit that means even greater freedom, ease, and safety in man's eternal quest to reach out and touch the stars!"

Bryan Kimberly pinched his lower lip thoughtfully. That had looked pretty good in script when he'd first read it. Now, in his pages of "Rocket Flight," it seemed just a trifle too purple. Oh, well—nobody could blame the company for going overboard on this new suit. It was *good*.

He read on. "For the first time, spacemen are offered an all-fabric suit. In weight alone, this means a reduction of thirty-eight pounds, Earth. The new plastic, Cordolite, of which the carcass is constructed, is conservatively rated at an inflation pressure of three hundred pounds per square inch.

"Most important of all, however, is the tremendous, epoch-making invention, the Kimberly Joint. It is with the utmost pride that we present this new joint to the spacemen of the world.

"Gone forever are the tragic blowouts of the old ground metallic joints. Though the greatest precision has always characterized Kimberly products, we were well aware of the imperfections of the ground joint, and we have devoted the full resources of our laboratories for many years to find a better solution.

"We have it. The Kimberly Joint is a continuous connection, spring compensated joint. Four hundred metallic springs embedded within the Cordolite carcass provide a completely compensated set of joints which assures the spaceman the mobility and freedom of a trunk clad swimmer. The illustration above, taken from an actual photograph, shows the first performance of its kind in history—made possible by Kimberly.

"Note also the new size of communication and pressure compensation equipment. No longer is the spaceman a walking Gargantua with a machine shop on his back!

"Trim! Safe! Comfortable! Kimberly!"

Bryan Kimberly finished with great satisfaction and folded his hands over his just barely perceptible paunch to enjoy the picture. Twenty-seven months of the hardest work he'd ever put in were represented there. He wished there had been time to get in the announcement that Lunar Flightways had equipped their new *Lunar Queen* all the way through with new Kimberlys for her maiden flight that was even now being completed. They had thirty-six Kimberlys on the *Queen* and four hundred more ordered for the rest of their fleet.

Maybe they'd run the advertisement again next month. It wouldn't be necessary in order to get business, Kimberly knew. Spacemen had been looking for a continuous, compensated joint since before the

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first rocket-took off.

He glanced at the clock. Time to knock off, and this was going to be one week end that was really off. Two days at their cabin. His wife, Bernice, and their son, Roy would drive up Sunday but for one day of solid sleeping and fishing he'd not see a human being. Bernice was away visiting and he planned to go directly from the office. But it was time to be going if he expected to make it by dark.

His anticipation was broken by the flashing of his secretary's light. He answered with expectant irritation. "Yes?"

"Mr. Johnson of Flightways is on the phone, Mr. Kimberly."

"Tell him I— Oh, put him on!"

Johnson appeared on the small phone panel, sputtering and red-faced. "Kimberly! Where have you been? I've been trying to get you all afternoon."

That was Johnson's customary approach and Kimberly paid no attention.

"We're canceling the order on those suits," said Johnson. "Those three dozen on the *Queen* are no good. Every one the boys tried out broke down with them. They stink.

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We're going over to Realworth's ground joints."

"Take it easy, now, Henry," said Kimberly with frozen deliberation. "You know how production is. There may be some bugs in the suits that we've overlooked, but we've tested them frontwards and backwards. We know they're good and we'll back them up."

"Bugs! There're enough bugs to crawl off with the suits."

"Just tell me what the trouble is."

"The *Queen* landed at Copernicus Central. The passengers were let off as usual and the crew began getting into the suits for terminal inspection of the hull and jets. Incidentally, those Iron Maidens stink, too. Why can't you figure out some kind of a dog for the joints so a spaceman won't have to get inside one of those things to put the suit on or off?"

"We're working on it," said Kimberly patiently. "We'll get it in time, but you want spacesuits now. And this is better than having to handle the old iron pants with a crane."

"Not much."

"Well, get on. What happened?"

"Twelve of the crew began the inspection. Chief Engineer Medford was watching from a port. All of a sudden one of the boys flipped back an arm like something had hit him with a ball bat. It just hung straight out. Then pretty soon another guy who was bending down on his knees to look below a tube straightened out and shot up nearly sixty feet to the top of the *Queen's* center deck."

"The joint counterbalances gave way!"

"You guessed it. In less than five minutes every one of those boys was spread-eagled and laid out over the landscape like gingerbread men. Some were still standing, but most were lying on their back and couldn't move a muscle. There has probably not been such a concentration of profound profanity in a location of like area since the beginning of space flight."

"I'm sure we can find—"

"Listen! Do you know how they got back into the ship?"

"I suppose they sent out some more men and hauled them back in."

"That's what Medford thought he was going to do. He sent out three more to attach lines and haul the others in. They got four hooked up and then *they* were laid out like a cooky cutter had run over them. Four for three—it wasn't a good deal. They still had eleven men to go. Medford tried one more and he only got one hooked up before his suit spread out on him and left him standing there."

"Well—how *did* they get back in?"

"They didn't. They're still there."

Kimberly sat back in his chair with a fishlike gulp. "Henry, you don't mean— When was— When did this happen?"

Johnson glanced at his watch out

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of sight of the screen. "Exactly thirty-three and one half hours ago. Those men are—"

"Well, you've got ground joint suits at Copernicus!"

"We'd switched over on the *Queen,* remember?" Johnson's teeth showed just a trifle now. "We believed in the reputation of Kimberly, and had the locks built for your new suits. We didn't have an iron pants aboard. In the terminal every blasted suit had been shipped out on an emergency call to that freight that exploded four thousand miles off course. You *do* read the papers?"

"And your—"

"My men are still there and will continue to be there for two hours and fifteen minutes more when Capitol's ship, *Carolinia,* whose owners have not been such fools as to adopt Kimberly suits, will let down and kindly assist my men back in."

"You could have—" Kimberly fumbled.

"No, we couldn't. Medford, the home office, our engineer's staff, and everybody else has been trying to figure it out for over thirty hours. A total blank. They couldn't get the men back in.

"There are just two more items, and then I'm through. Number one: Your suits are haunted."

"Haunted!"

"Screams like a built-in banshee nearly drove the men crazy for a while until they were laid out. It was so high-pitched they could scarcely hear it at first, but it was there. Is it one of your improvements? I didn't notice anything about it in this spread you have in 'Rocket Flight'."

"Look, Henry, our suits may spread eagle, but they don't scream."

"Seventeen men on the Moon say they do."

"Must have been defective radios oscillating."

"They cut them off. The suits are haunted. You know what happens to a ship or piece of equipment when something like that starts around. It doesn't have to make sense."

"Henry, we'll—"

But the screen was suddenly blank. Kimberly was saved the necessity of trying to think just what they'd do at the moment.

He put his head between his hands and groaned. He felt as if a large meteorite had rolled slowly over him. The two-page, four-color advertisement of Kimberly Suits was still spread out on the desk before him. A sudden taste like half ripe vinegar filled his mouth. He slapped the magazine shut and gave it a shove that sent it over the edge of the desk to the floor.

Haunted spacesuits! Awghhh—

And the Kimberly Joints? They had been tested under every conceivable circumstance. In the space room they had been flexed millions of times at a temperature of 0.001 degree K. The metallurgy department had come up with an alloy that

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looked like perfection. Hundreds of thousands of the springs had been tested without failure before a single one had been built into a suit.

And now they should fail.

And haunted to boot.

He tried to think what the screaming sound might have been. He could only suspect the communicator. And that had been cut off. Perhaps it was some psychological effect. Probably a minor matter, anyway. Of greatest importance was the failure of the Kimberly Joints. If they couldn't be perfected, the company would have to close up or start making flat irons and electric mixers.

He got up slowly and went out through the now empty outer offices. All the hired help had gone home. He supposed there'd still be a few of the boys puttering around in the labs, but he didn't want to see anybody.

He went down to the main floor where production lines were frozen in mid-motion. Scores of suits in all stages of production hung on the movable racks. He walked slowly down the line, from the point where the plastic came from the molds, past the subassembly sections where the intricate regulator valves and communication sets were put together, past the optical section where the circle of hundred and eighty degree lenses were set into the headpieces.

He walked by the test chambers where each plastic carcass was tested for pressure and cold after the Kimberly fastener, an air-tight pressure zipper, had been installed. He glanced through a peephole at a score of pressure regulator valves on test. At the end of the line, he reached out to touch a completed suit, set up in its Iron Maiden, ready for shipment.

When he was a kid he'd read stories of space flight, and that was just before space flight had actually begun. Invariably, in the stories, the clean-cut young physicist or engineer would have occasion to hastily don his pleated, gabardine spacesuit and rush out into the vacuum of interstellar space on some urgent mission. Anyway, it looked like gabardine or something of the sort the way it was drawn by the illustrators. In total vacuum, the material hung in manly looking folds that made the hero look like a champion skier about to take off. Always, of course, the headpiece was a uniform, transparent globe. Kimberly wished he knew what material the artists had in mind for those globes, especially when the neck opening was too small to permit removal.

He glanced wryly at the thick headpieces of his own suits with their ugly semicircle of hundred and eighty degree lenses, and the stubby antenna sticking straight up. Maybe some day they'd get to the transparent globe stage—but it looked a long way ahead, especially in view of Johnson's complaint.

He trundled a carrier up to the nearest finished suit and mounted it, then wheeled slowly towards the space chamber down the line. An

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"icebox", the engineers called it. There was only one way to find out what was wrong with these suits—

He entered the lock of the chamber and closed the door. He chucked the Iron Maiden off the carrier and stripped off his clothes. From a closet he took a special liner and put it on. It resembled very closely a pair of ancient red flannel drawers.

It used to be that it took at least two other men to get one into an iron pants suit. For the first time now a man could get into a suit by himself—if the suit was a new Kimberly, and provided the Iron Maiden was there to hold it. Without her, six men and a boy couldn't put the suit on him.

Burton, the young engineer who was chiefly responsible for the new joints, was working on a system of dogs to make the Maiden unnecessary, but so far they weren't quite practical.

The Maiden was necessary because the tension of the counterbalances in each of the joints would otherwise have folded the suit into an intractable wad. It was surprising how many newcomers in the various branches of engineering associated with space flight did not appreciate the magnitude of the problem of joints and pressure regulation. So many of them thought all you had to do to build a spacesuit was make a man-shaped balloon, put a man and some air into it and turn him loose. They never realized that a man in such a rig would be spread-eagled by the air pressure that forced the suit to maximum volume and held it there. It wouldn't permit a man to bend an arm or move a leg. And if he could move, the changing volume would introduce such a violent change of air pressure in the suit that it would be uninhabitable.

The springs of the Kimberly Joint were ingeniously built into sheaths in the fabric in such a way as to counterbalance this spread-eagling force, thus leaving the spaceman free to move his body in a somewhat normal fashion.

But the springs, in turn, made the ungainly contraption nicknamed the Iron Maiden necessary to hold the uninflated suit.

So far, all means of dogging the counterbalances made it impossible to get into the suit, properly inflate, and then remove the dogs. In the Maiden, the suit was held rigid and the right arm dogged so that the openings could be closed and the suit inflated. Afterwards, the left hand was used to undog the right arm.

It was cumbersome, complicated, and ungainly, a lot different from the boyhood heroes Bryan Kimberly had read about, those dashing engineers who were forever shucking on a spacesuit at the drop of a ray gun and clearing the void of all that stood in their way.

But it was an improvement over the old ground joint, iron pants outfits, with their continual blowouts and violent deaths. So far, space flight had become useful only to the degree that suit engineering had

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freed men from the confines of the ships to explore the surface of the Moon.

And some day a Kimberly would make the first human footprint on the surface of Mars—

Kimberly slid his legs into the suit, then hunched down and drew himself into the rest of the carcass. He stood up straight, sliding his arms into place and raising his head into the dark, tight cavern of the headpiece. More than ever, he wished those writers and illustrators of thirty years ago had left proper specifications for those beautiful suits and transparent helmets they designed. A suffocating, claustrophobic sense filled him momentarily. As good as they were, the lenses gave the impression of looking between fantastic bars—as his sight shifted from one to another. It was difficult to get used to the distortion of field that they presented to his eyes—but some day there'd be transparent headpieces.

With his right arm, he closed the belly opening through which he had entered. Like Jonah in the belly of the whale, he thought. The inch and a half thickness of Cordolite felt cold and clammy even through the liner. He turned up the heat control by means of the switch at the end of the left sleeve.

The swirl of air began to fill the suit as he began inflation. The fabric was a close fit in most areas except for the helmet and sleeve terminals where the controls and digital manipulators were located.

The warmth made him more comfortable, but didn't dispel the conviction that he'd rather manufacture the suits than wear them. As the air pressure rose to normal, the suit became free in the Iron Maiden and he stepped out, undogging the right sleeve. He went to the controls of the air lock and started the pumps that would evacuate the lock and reduce the temperature to that inside the icebox. While he waited, he checked the row of tiny meters just inside the lower range of vision at chin level. Temperature, pressure, tank pressure, voltage of the power pack—they were normal. Except for the tank; it wasn't up to full capacity. He wondered if he should fill it. But there was no need. He wouldn't be in the lock more than an hour at the most.

The door automatically swung open as the pumps completed the evacuation. He stepped through into the test room and closed the door behind him.

The score or more of hanging, bulging suits in their racks across the room seemed like waiting corpses for some reason. The utter silence, the knowledge of the absolute cold and vacuum beyond the thickness of the suit always depressed him. He knew he'd never have made a spaceman. They got used to it, they said. But this was the nearest he'd ever get to the thrill of space adventure, he was certain.

He reached up above his head to check the door clamp again, and

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scowled at the peephole transmitter and mike just below it. These were for the operators setting up the chamber for a test, but they were automatically on whenever the door was closed. Safety precaution some bright lad had devised, Kimberly thought. Some safety for a guy in a spacesuit in there with no air, though.

Yet it gave him an absurd, comforting sense of connection with the world of the living, even though no one but the watchman would be out there somewhere in the building.

He walked over to the row of suit carcasses. They looked all right. Their telemeters showed pressure and temperature being maintained at normal in all of them.

Kimberly felt a surge of growing irritation. There was nothing wrong with these suits. It must have been something to do with the *Queen* or conditions on the Moon that broke down those others. It made no sense at all. And he'd never get to the cabin by dark, now.

But though there was nothing wrong, how could he take the week end off until he had proven positively that it was so? In a burst of anger he hauled back and punched the nearest carcass in the belly. It jolted back and sent the whole rackful reeling in their hangers like, like—dead men swinging in the wind, Kimberly thought morosely.

Then he heard it.

A slow, shrill screaming in his ears. Trilling up and down the scale, it escaped momentarily beyond the range of audibility, then slid down in wild, despairing crescendo.

The hair prickled on the back of his neck. He turned the heater up a notch and whirled about, as if to find the source of the wailing behind him.

There was nothing, of course. And Johnson's words came back to him. "Your suits are haunted."

Of all the incredible nonsense! But where *did* the sound come from?

He realized now that it had been there all the time just on the verge of perceptibility. But his senses had not recorded it until the cold, depressing surroundings began to weigh on him.

Psychological.

He listened hard, straining his ears with all the voluntary effort he could muster. Even his heartbeat began to sound loud inside the suit.

It was there. Actual, physical sound waves were producing that sensation. It was no mere delusion of the senses. He was certain of that.

He looked at the row of carcasses that had almost stopped swaying. Fiercely, he jabbed out again.

A wild scream pierced his ears. Simultaneously, his arm snapped back as if it had been hit with a club. In half numbing pain, he regarded his arm. It projected straight out at his side—immovable.

For a moment he looked at the swinging carcasses. It was almost as if they had struck back.

But he knew what it was. The

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elbow and shoulder joints had broken down completely.

Springs, he thought, that could withstand five million flexings in the test machines in the icebox, yet they failed with a few flexings when in a suit.

He made a tentative gesture to bend the stiffened arm. It only made his bruised muscles ache worse. The sleeve would not move—as he well knew.

He tried the left arm, flexing it slowly. It seemed all right. He dug his manipulators into the thick plastic of the right sleeve to feel of the springs in the joints. There simply weren't any. He rubbed the fabric back and forth between the manipulators. Lacking a sense of touch, he couldn't be sure, but it seemed as if there were fine metallic shards in the thin sheaths where the springs should have been. They had shattered to bits.

Cold?

They had been tested for months in the icebox. Stationary, flexed at a hundred cycles per minute, heated, cooled again—everything the test engineers could think of had been done to those springs to break them down. And they held.

Until now.

He moved towards the swaying carcasses.

"How are you boys doing? Let's feel that muscle." He flexed the arms of the nearest suit with his left hand. The legs. The joints seemed satisfactory. He went on down the line. As he reached for the next to the last one, his left arm snapped back.

He stood there like some fantastic scarecrow, arms outstretched—swearing very softly to himself.

With impotent rage, he tried to bring his arms together. It was like trying to squeeze a block of cement. That was the physical factor behind his rage. But the psychological was greater. The inability to even guess at what was going on right under his nose. It was almost as if the springs were allergic to man. They withstood every physical torture that engineering could devise. But mounted in a suit and worn by a man, they failed.

Kimberly gave a shrug of disgust. He'd be suspecting somebody of hexing the suits next if he kept up that line of reasoning. There was a perfectly logical, physical explanation for the failure of the springs. It was right under his nose. It must be fatigue that kept him from seeing it, he thought. At any rate, there was nothing more to be done, now. He couldn't accomplish anything with his arms sticking out like boards.

He might as well get out of the suit and have some dinner. Then he'd call the engineers down for an all-night session if necessary. The week end vacation was off. He'd have to let Bernice know he hadn't left. He started for the door.

And nearly fell on his face.

He hadn't even heard it or felt it. But while he'd stood there the entire set of springs in the left leg of the

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suit had collapsed and left him stiff-legged.

Sweat suddenly formed a moist film on his face. If the right leg should also go, he'd be in one sweet jam!

Cautiously, he tested it. He raised one foot slowly and carefully, making sure to maintain his balance on the leg that couldn't be shifted if he needed its sudden counteraction.

All the joints of the right side were still good. But it was a gamble how long they would hold. More than seventy-five percent of the springs in the suits were gone now. He couldn't expect the rest to last much longer at that rate.

Irritation gave way to apprehension lest he fail to make it to the door of the chamber. Carefully, he put his foot down and gave an awkward hop. His instinctive dependence on both legs nearly undid him. He tottered in the heavy suit and fell against the row of carcasses.

That saved him long enough to regain balance. Sweating heavily now, he turned the heat lower and made another try. That one was more successful. He gained about a foot on that hop. The door was—

Suddenly, it seemed a vast, incredible distance away. The twenty feet that separated him from it loomed like a journey of pioneering proportions. He cut off that line of thought and concentrated on the next hop.

He soon had to leave the protecting lee of the line of carcasses that had twice served to balance him. They were like old friends whose sudden departure now was tragic.

He hopped away. One slow step, and another. At midpoint he half stumbled, then recovered. He paused. His breathing was coming hard and fast. The muscles of his leg ached to the point of collapse.

Calm down. Take it easy, he told himself savagely. There was nothing to get excited about. He wasn't stranded on some barren desert of the Moon. This was his own factory where he spent ten or twelve hours of nearly every day. This was home territory. He could hop another ten feet and jerk that handle that would open the door and let him into the lock.

He resumed the slow maneuvering. Nine more. Eight. Almost there wouldn't be good enough. If the remainder of the springs gave way with just two feet to go, it was still no better than when he started out. He had to make every single one of those hops. And each one lessened the chance of making the next. And all the while the ghost screamed in his ears.

When he finally reached the wall he almost cried. With outstretched arms, he leaned close against it, hugging the chill, imprisoning surface. The pain in his leg was sickening, but he forced it to hold him up while the aching muscle cells slowly recovered.

He was safe, now, he thought. Safe. What had he ever been afraid of? He knew the answer to that

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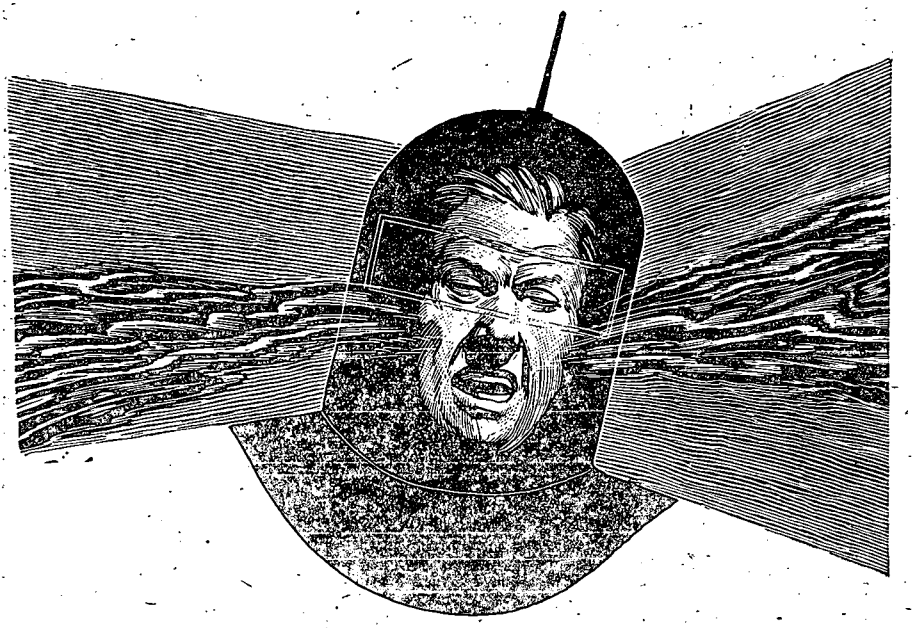

well enough. It had always terrified him. The emptiness, the cold. He'd never get to the Moon. He'd never be a spaceman.

He looked up at the door lever just above his head. One pull on that and he'd—

One pull—

The chill of space seemed to filter through the Cordolite. One pull on the lever was all it would take. And how was he going to reach the lever?

He moved sideways and glanced from the tip of his sleeve to the lever—about twenty-four inches. It might as well be twenty-four feet.

Instinctively, he looked around. There was nothing to stand on. He cursed the futility of his thought. As if it would do any good to find something to stand on.

He looked again at the two-foot vastness between his hand and the lever. Involuntarily, his body contorted in an attempt to twist upwards towards that key to freedom. The whispering, screaming sounds mocked the futility of it. Almost, he screamed back at it.

There had to be some way to reach that handle. He squirmed, tipped, tipped farther—

That was it!

Spread-eagled against the wall, he slowly tilted on one leg like some fantastic windmill. Inch by inch, his hand neared the handle. Half the distance was closed. Then he saw the arc of his arm would not

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intersect the position of the handle. He straightened and moved more directly under it.

He tipped again. This time he would make it. Glancing through the lens of the headpiece, he saw the gap narrowing. That image was all that was real in the world. He concentrated on it, willing the gap to close.

That concentration cost him his sense of balance for a bare instant. Only an instant, and disaster swept upon him. He tottered, felt the sickening sense of lost orientation.

Soundless in the vacuum of the test chamber, the heavy suit crashed to the floor.

Bryan Kimberly cried then. Cried of exhaustion, frustration, loneliness and terror. He lay on his back seeing only the ceiling, a gray mass of steel in which were set the thick lenses that barred even the faint infrared radiation of the chemical lights which illumined the chamber.

How long he lay there looking up at that gray, hypnotic field with its glowing white spot he didn't know. He knew that he could not get to his feet again, and knew equally well that sooner or later he would begin struggling. But not just yet—not just yet.

This would work out all right, he tried to reason with himself. Someone would find him and relieve the ridiculous situation he had placed himself in.

Who? When?

This was Friday night. He glanced at the little clock face in the headpiece. It was after ten p.m. In the morning someone would miss him. But who? He thought carefully. Bernice expected him to be on his way to the cabin now. She wouldn't expect any communication from him. No one would.

Roy was driving her to join him Sunday morning. That meant not before ten o'clock, anyway. Thirty-six hours away. And it would take them time to become alarmed over his absence. They would make calls. There would be investigations by the police, fumbling, bumbling, wild guesses. Someone would finally think of checking clear back to the plant. His secretary, Doris, would remember that he hadn't left when she had.

But who would finally think to look for him in the icebox?

It would be Monday at least before they got around to searching the plant in such detail.

By then it wouldn't matter. He had been watching the air gauge for a long time now. There was only enough air for thirty-two hours at the most.

He lay there for another hour without moving. His mind seemed stunned beyond functioning by the calamity of his fall.

But after a time he wondered idly what had happened to the ghost. Perhaps it had taken pity on him and wasn't going to haunt him in his present predicament, anyway. Whatever the reason, the absence of that

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high-pitched screaming was one small blessing to be thankful for.

Or was it? Even as he thought about it he shifted his one free leg and the sound piped faintly in his ears. The irritating, knifelike vibration channeled through every nerve path and shook his body. He kicked out violently in an effort to shift position and ease the aching spots of contact between his body and the suit.

The sound surged to a higher, more racking pitch, then passed beyond audibility.

Ghosts.

In a spacesuit. In an icebox. He laughed sharply without humor. Our suits may spread eagle, but they don't scream. Johnson would be pleased to have his confirmation that they did scream. As if Johnson would ever know what he found out—

He clenched his teeth. If he was going to die here, he could at least die sane. And if his brain were still functioning he should be able to figure out that scream.

What makes sound? Vibration. Of what? He thought of all the elements of the suit that might vibrate. There weren't any. Unless—

Air columns vibrate. But there weren't any air columns. No—but there was air going through an orifice. That made a whistle. Suddenly he laughed out loud. He kicked his leg sharply and listened to the resulting shrill scream.

"Hello, ghost," he said.

It was the pressure regulator valve in the back of the suit. Every time a joint of the suit moved the volume decreased or increased with a change of air pressure inside that might be as much as a hundred percent. The regulator valve took care of that. As the volume decreased the valve drew off some of the air to a low pressure tank. As the volume increased, it passed back some of the air from a high pressure tank, thus maintaining constant air pressure within the suit regardless of the contortions of the occupant. When the low pressure tank was filled, an automatic pump evacuated it to the high pressure tank.

This complex arrangement could, of course, have been eliminated by a simple exhaust valve—but that would have been too wasteful of the suit's air supply which was even freed of carbon dioxide and excess water vapor by chemical means and reused.

So, from some accident of design or construction, the regulator whistled and screamed at the occupant every time it was called upon to adjust the pressure. It was very nearly a supersonic vibration. Certainly it had harmonics way up in that region.

Kimberly moved his leg slowly and listened to the sound. He jerked sharply and the valve squealed with horrible insistence. Almost made it talk, he thought. He moved jerkily in imitation of spoken words. The valve responded with weird cries and chilling screams.

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And so he knew the answer to that one.

But there was no pleasure in it. For a moment it had distracted his mind. Distraction, however, would have to be extremely powerful to draw attention from the kind of death he was facing. At the end, he supposed it would be simplest to just open the exhaust valve as quickly as possible.

His eyes, wandering aimlessly, settled on the communications panel directly above his face. The mike there, connected to the outside world, mocked him with its ability to carry a cry for help that might be heard sooner or later by a watchman. But nothing on earth would carry his voice through the thick fabric of the suit and across the five and a half feet of vacuum between him and the mike.

A carrier. He had the radio set in the suit. Useless in the metal walled room.

Carrier—

He trembled suddenly. He had a carrier—maybe. A ghost could carry a message for him.

He laughed a little hysterically and it relieved his tension. He couldn't be sure it would work, he told himself. No use building hope until he knew. This solemn rationalization couldn't still the hard beating of his heart. He wanted to live, and the involuntary muscles of his body refused to be stilled in the face of reviving hope.

He moved his free leg until his knee came into his sight. Slowly, he shoved himself backwards until he could touch the wall with the digital manipulators of one hand. He spread them until they made the greatest possible contact with the metal wall.

Then he raised and lowered his knee slowly. The faint, high scream of the valve pierced his audio nerves.

He opened his mouth and called with a voice that thundered in his own ears. "Open up! Open the icebox. Bryan Kimberly—in the icebox. Open—"

A carrier—and a modulation. The one point of contact between the inside and outside of the suit was the manipulators. Though they had an intermediate section of heat inert plastic, they were rigid. They would carry the supersonic vibrations from the valve to the wall. His voice alone would never pass through the manipulators in force sufficient to reach the mike. As he called, the vibrations of his voice produced pressure changes within the suit and the valve responded at like frequency, modulating the high-pitched sound it generated. And those narrow fingers might be able to carry that spear of inaudible sound with his voice riding its back out to the wall.

He pictured the rest of the pathway—up the metal wall to the mike chamber where the supersonic component would be lost on the condenser element. Would his voice

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component be strong enough to activate it?

He couldn't know. He could only try. And the still active Kimberly Joints would not remain intact indefinitely. Already they were moving on borrowed time.

He remembered that George, the watchman passed the assembly line on his hourly rounds at about ten minutes after the hour. He'd seen him only a couple of nights ago checking the watch station near the icebox.

He adjusted his calls to half minute intervals except for six or seven minutes before and after that critical time when George ought to be in the vicinity.

The hours stretched past dawn and rawness grew in his throat. The deafening, insistent roar of his own voice echoed in his head. And no response had come. He felt that there had been moments of unconsciousness during the night, and he dreaded that he might have missed a single chance for rescue. He glanced at the clock face. George was gone by now. Kimberly wasn't sure how the day watch was handled on week ends. He gave up the continuous calling and maintained the intermittent schedule as nearly as he could.

How could it be such torture to simply lie still? A beating with a club would not have made his body ache more. He tried to cut his mind off from the sensations of pain and concentrate on the mechanical routine of his calling. He found that too easy to do. His mind wanted to slip completely into forgetfulness under the burden of pain, fatigue and monotony.

He dared not go to sleep. He fussed with the pressure and heat controls. Perhaps a little more cold would keep him awake—

George was not a very bright boy. He heard Kimberly's voice on three successive rounds before it made an impression. He didn't know much about the equipment he was supposed to watch. It didn't seem quite plausible that he should hear the top boss' voice in the silence of the assembly floor and he didn't know anything about the communication panel for the icebox. So he put the whole thing down as imagination.

Twice, anyway. The third time he gave in and called Kimberly's house.

It was long after midnight Saturday when they found him. The Kimberly Joints had given way hours before and he lay inert and unconscious. He had turned the heat much too low in an effort to keep awake and his body was chilled. But he was still very much alive. Revival was accomplished with little difficulty.

On Monday morning an uneasy dozen engineers sat in the small conference room off Bryan Kimberly's office. They had heard rumors, vague and terrifying rumors that the boss had got into some jam that was their fault. They had heard rumors

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of a rage that was unmatched since the days of Kimberly, Senior, who used to turn over his whole engineering department before lunch about once a week. They wondered where they would be working by the end of the week—if they were working at all.

They didn't look much at each other, and they didn't talk at all. There was Conners, the metallurgist; Jenkins, the plastics man; Randolph, the mechanical engineer; and Brown, who had been chiefly responsible for the final design of the new suit. Burton, the joint designer was also there as was Lane, head of Test Engineering.

They stared mutely at the gadget Kimberly had rigged up in the center of the conference table.

"Wonder what—" Lane finally began.

"New model of an improved guillotine," suggested Jenkins.

"Shut up! Here comes the boss," Brown hissed.

They hunched down, looked towards the door expectantly.

Bryan Kimberly entered and closed the door softly. He looked the same as far as they could tell. They wondered just what had happened to him.

"Gentlemen," said Kimberly. They sank still lower. This was going to be worse than they had thought.

"Gentlemen," he repeated. "I don't know much about what they teach in college these days, but when I was a kid they required all engineers to have G.S. 1, fundamentals of general semantics. In that course I remember learning one great lesson: The whole is *not* the sum of its parts. Ever hear of that, gentlemen?"

The circle of glum engineers nodded, and they wondered where the devil he was heading for.

"I have discovered that in spite of the fact that this company is supposed to have a test department and has a number of test engineers on the payroll we, nevertheless, turn over untested spacesuits for sale to our customers."

Lane bristled, terrierlike, and squirmed out of the chair to a standing position. "If there have been complaints against my department, I'll back up every suit that's got my inspectors' stamps on—and none go out without them."

"No—none go out without them," said Kimberly with slow, even precision, gently dangling the hook he had them on. "But there is one other great lesson of general semantics that you seem to have forgotten, Mr. Lane. The word is not the object. Remember?"

"But what—"

"It simply means that because a suit bears an inspector's stamp there is no reason to assume the suit is tested and perfect."

"Then what does it mean?" asked Lane.

"It means that we have a test department manned by thick-headed, vacuum-brained imbeciles," roared

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Kimberly. "Kids who play like engineers—"

Lane trembled before the blast, but remained standing. "Mr. Kimberly, we are engineers with reputations to maintain. We back up our reputations with our work and—"

"Would you like to back them up—*on* your back for a day or two in one of those blasted *tested* suits of yours?"

"I would appreciate knowing what factors we overlooked in our test procedures."

"That's simple. You forgot to put a man inside."

Lane swallowed. The others looked baffled.

"You don't expect us to give each suit an occupation test, surely," said Brown. "It's not practical and . . . and surely not necessary. We test for operation, durability. We test the final suit for pressure. It seems to be there's nothing omitted."

"Piece by piece!" growled Kimberly, his fist banging the table. "And the whole is not the sum of the parts! Will you get that through your heads? A suit is not tested until it's shown that a man can wear it. Your tests do not show that. Look at this."

He pressed a button connected to the apparatus on the table. A projected silhouette flashed on the wall.

"A spring from a Kimberly Joint," said Bryan Kimberly. "Those wonderful Kimberly Joints! I took this off the production line. The test sample out of this bunch flexed four million and was still good. Now, watch."

He pressed another button. "This box is near zero, Kelvin. The spring is cooled with liquid helium to near operating temperatures. There it goes!"

As they watched, the silhouette shattered. The pieces seemed to explode, then trickled out of sight and there was nothing where the spring had been.

The engineers sat as if stunned. They knew the strength of that bit of metal, the implications of the force that could shatter it like glass.

"What did you do?" breathed Lane.

"Ghost," said Kimberly. "Don't you hear it? Our suits are also haunted, you know."

They listened. Then they heard—the high-pitched screaming that came out of the apparatus.

"One of our *tested* valves," said Kimberly.

"But they don't squeal like that," said Lane.

"How do you know? Do you test for squeal?"

"No, but—"

"Supersonic, mostly," said Kimberly. "At operational temperatures that vibration will shatter those springs to bits. Seventeen men of Flightways were left spread-eagled for a day and a half on the Moon. Your *tested* suit almost killed me when I tried one on in the icebox.

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Now, does anybody want to claim these suits are tested before they go out?"

"But a squeal—" Lane protested weakly.

"A squeal. You test the valves in an icebox. Nobody learns whether they squeal or not because the sound is too high for the mike in there. You put them in a suit and test the suit for pressure—constant pressure where there's no squeal. But when a man puts the suit on and the valve starts working, the springs go to pot. We gave the suits a thorough occupational test when the springs were designed, and then we changed the valves *after* such tests were made. Any questions now, gentlemen?"

He looked them over with savage enjoyment of their discomfiture. "Good, then we may expect a revision of the test procedures and a correction of the valve design."

THE END

THE ANALYTICAL LABORATORY

Herewith we report on two issues of the magazine There were six stories in the June issue, and seven in July—wherefore the point scores are all high, since stories tended to get votes for not only first, second, third, fourth, and fifth place, but also for sixth and seventh. In June, there was also the "Aphrodite Project," by Philip Latham. As an article, it isn't rated with the stories—but I can most certainly say it was commented on more extensively than any story! Hereafter, be it remembered, that such pieces will be called "Special Features"; that should clear away confusions. At any rate, herewith the reports:

JUNE, 1949

Place	Story	Author	Points
1.	Needle (Conclusion)	Hal Clement	2.2
2.	Minority Report	Theodore Sturgeon	3.19
3.	The Green Forest	A. E. van Vogt	3.5
4.	A Sound Investment	René Lafayette	3.72
5.	To Watch the Watchers	W. MacFarlane	3.96

JULY, 1949

Place	Story	Author	Points
1.	Eternity Lost	Clifford D. Simak	2.2
2.	Agent of Vega	James H. Schmitz	2.53
3.	Animal Cracker Plot	L. Sprague de Camp	3.5
4.	Trip One	Edward Grendon	4.34
5.	Adaptation	John Beynon	4.52

I hope—as, evidently, many of you do—that Simak continues his new series. And, incidentally, Schmitz takes the cover on the December issue.

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TIME HEALS

BY POUL ANDERSON

It's a safe bet that, eventually, men will find a cure for all diseases; if only a sick man could wait long enough, time would, indeed, heal. But it can also hurt—

Illustrated by Brush

Hart followed the doctor down a long corridor where they were the only two in sight and their footsteps had a hollow echo. The fluorescent lights were almost pitilessly bright, and the hall was silent. Silent and empty as—death? No, as the Crypt at its end, as timelessness.

Hart's lips were dry, his throat felt tight and his heart beat with a rapid violence that dinned faintly in his ears. He was frightened. Why not admit it? The feeling was utterly illogical, but he was scared silly.

He asked inanely, as if he and all the rest of the world didn't know: "There won't be any sensation at all?"

"None," replied the doctor with a patience suggesting he had led many down this hallway. "You'll stand on a plate between the field coils, I'll throw the main switch, and—as far as you're concerned—you'll be in the future. Time simply does not exist, as a 'flow' at any rate, in a level-entropy field."

Hart licked his lips. "It's like dying," he said.

The doctor nodded. "In a way, it is death," he replied. "You'll be leaving everything behind you—family, friends, the whole world in which you have lived. You can't go back. When you're released from the field—ten, fifty, a hundred, a thousand years hence maybe—you'll be irrevocably in the future." He shrugged. "But, of course, you'll live, whereas your only choice in this era is death."

"Don't get me wrong," said Hart. "I'm nervous, sure, but I'm not scared. I have every confidence in your machine. It's just that I never

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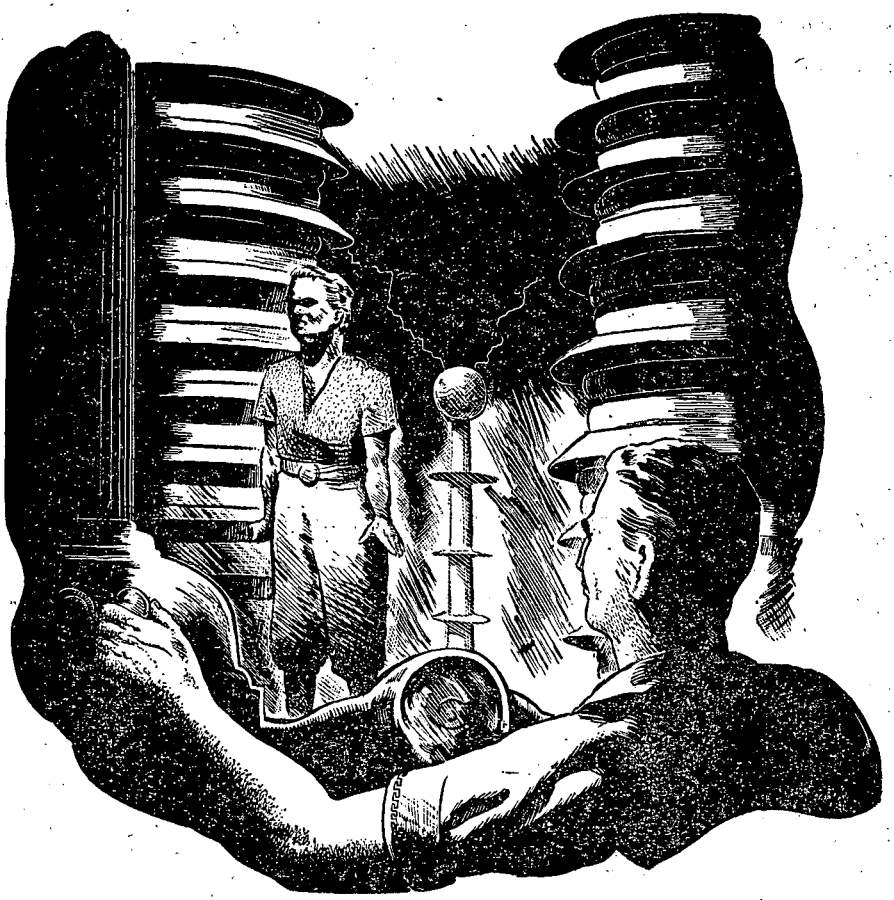
did understand the principles of it, and of course one is naturally skittish in the face of the unknown."

"It's very simple," said the doctor. "The newspapers have, as usual, made a horrible mess of trying to explain it to the public, and all the legal and moral argument it's stirred up have further confused the issue. But the scientific basis is very simple indeed." He adopted a lecturing tone: "Time, of course, is a fourth dimension in a more or less rigid continuum—that's putting it very crudely, of course, but it shows that simple relativity gives no reason why time should flow, or, if it flows, why it should do so in one direction only. That difficulty was resolved by suggesting that the increase of time was the general increase of entropy throughout the uni-



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verse with respect to the 'rigid' time dimension. Again, that's a clumsy way of putting it, but you get my general idea. I don't pretend to understand the details of it myself.

"Anyway, just a couple of years ago, in 1950 I believe, Seaton found an effect, a field, in which entropy was held level. An object in such a field could not experience any time flow—for it, time would not exist. The generation of such a field turned out to be fairly simple once the basic principles were discovered, so that before long we had—the Crypt."

Hart nodded—although he didn't understand it even now. Science had bored him, he regarded himself as a natural-born aesthete and observer of man, a pursuit which a medium-sized independent income made possible. He wrote a little, painted a little, played the piano a little, went to all the exhibitions and concerts, chose his friends and occasional mistresses primarily on a basis of conversational ability, and in general had a pretty good time.

The fundamental idea of the Crypt was hardly new to him. He had read the old legends—the Seven Sleepers, the tales of Herla, Frederik Barbarossa and Holger Danske—of men for whom time had stopped until the remote future date when they awoke. Only last night, his last night in this world, he had played the whole "Tannhäuser" in an orgy of sentimentality.

There was always a catch. But he had very little to lose. A cancer which had metastasized to the lymph glands meant a short and unpleasant life, perhaps prolonged by operations hopelessly carving away more and more of his flesh—better to take some poison and go out like a gentleman.

Or, better yet, go into the future when they would have worked out some sure and easy cure for his sickness. And perhaps, he thought, a cure for the political cancers which ate at his own society, a cure for war and poverty and misery. Utopia was not inherently unattainable, to a close approximation anyway— For a moment he was almost looking forward to the adventure, but the tightness and the heavy pulse wouldn't leave him. He liked his present existence and the future would have to be pretty good to make up for his present.

Though I'm lucky, he thought. *I have no really close ties, none who'll really miss me or whom I can't live without. And I have a high I.Q. and adaptability, I can get along with almost anybody. I won't suffer.*

He asked: "Are there any people besides those with diseases at present incurable going into the Crypt?"

"No," answered the doctor, "except, of course, husbands and wives who wish to accompany their sick spouses, and a few other special cases like that. We just don't have room for any more.

"Naturally," he went on, "we're swamped with applications from

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people who want to escape the tribulations of the present for a presumably happier future. But those we ignore. There's been talk of developing level-entropy units which can be used for everyday purposes like preserving food or other perishables, or even in the household. Imagine cooking a chicken dinner, putting it in the field, and taking it out piping hot whenever needed, maybe twenty years hence! But the manufacturers are very careful about releasing stasis generators, precisely because too many people would try to take a one-way ride into tomorrow. What would become of the present—and would the future want our neurotic escapists?

"Several state legislatures have already tried to regulate the use of the Seaton effect, and Congress is arguing about a Federal law. Meanwhile, the Crypt staff uses it simply to save lives which are lost to the present anyway."

"If you can be sure they are saved—" murmured Hart.

"Of course, we can give no hundred-percent guarantee," said the doctor with elaborate patience, "but I think it's a very safe bet. The Crypt is in an underground vault well away from any area which might be presumable atomic-bomb targets. Not that even an atom bomb could penetrate a stasis field. Once the fields are set up, they're self-maintaining until neutralized from outside. Information about the Crypt is diffused throughout the world by now, even if something should happen to the permanent staff, which is unlikely. Whenever a cure for a specific disease is found, we will consult our records and release those suffering from it."

"Yes, yes, I know all that," said Hart. "But what kind of future—"

"Who knows?" The doctor shrugged. "But I don't think it will be too hard to adjust. I rather imagine that a smart Roman or Elizabethan Englishman, say, could do very well for himself in the present. Besides, at the rate medical science is advancing, I don't think anyone will be in here longer than fifty or a hundred years."

"And making a living—"

"You invested all your money as safely as possible before coming here, didn't you? You'll still have it when you awake, then, or the equivalent of it if they change the fiscal system. The Crypt staff will see to that if it isn't taken care of automatically. You'll also have quite a bit of accumulated interest."

Hart nodded his sleek dark head. "It seems as sound a proposition as human ingenuity can make it," he said. He added wryly, "Anyway, there's no point in quibbling, not when the old man with the scythe is so close."

"Quite so," said the doctor.

They came to the end of the passage, where a great vault door sealed off the Crypt itself. The doctor worked the multiple combination

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lock, remarking idly, "Even if this whole place should be destroyed, the sleepers would be safe. Literally nothing from outside except a neutralizing field can penetrate the stasis. You could be buried under ten tons of earth without its making any difference—till they dug you out and opened your field."

"There are things worse than death," muttered Hart, and then added quickly: "But hardly worse than death by cancer."

"Quite." The doctor started the little motor which opened the huge door. "In a way," he said, "I envy you. You'll wake up rich, in a society which is better than ours—it must be, it couldn't be much worse—and has all the great new adventures we're just beginning to glimpse—the planets, the stars—" He shrugged. "I may see you again, of course. They're working hard on the cancer problem right now. But I'll be a pretty old man then."

Hart nodded. "Benjamin Franklin once said he wished that, after he was dead, somebody would wake him every hundred years and tell him what had happened. I see his point."

They entered the Crypt. The room was a huge one, cold in steel and concrete and the white fluorescent lighting. There was little about to suggest the sensation it was arousing in the outer world. It looked much like a burial vault—a sinister thought, that, and one which Hart did his best to abolish—with its long row on row of steel caskets sliding into the walls. Each box, Hart noticed, had a complete case history engraved on its end.

The doctor followed his eye. "Those supplement our other records, in case they get lost," he said. "The future physicians can read directly what is the matter with each patient. And just in case something should happen to the Crypt itself, everyone takes another case history into stasis with him, like the one you're carrying now. So if it should become necessary, if nothing else survived, you could always be 'wakened' for the sole purpose of reexamination. But all those precautions are more for the benefit of worriers than because we think they'll ever be needed."

"The patients are actually in those . . . coffins?"

"Yes. The Seaton generator throws an almost cubical field about the subject. You've seen pictures or movies of it—a totally reflecting region, six or seven feet on a side. This field is, as I said, inherently self-maintaining. I heard Seaton himself lecture once, and he said something like the field requiring finite time in which to break down—only there is no time in it. Anyway, we find it most convenient to store those, uh, blocks of frozen time in the vaults you see."

Hart licked his lips again. He had always had a touch of necrophobia, and his hands were damp and cold now. To be frozen in time like a fish in a chunk of ice, and stowed

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away in a steel box for no one knew how long— He had a morbid desire to see his own coffin, but did not indulge it. That would not have fitted the picture he had of himself, which was somewhere between Epicure and Stoic.

They came into a smaller room at the end of the Crypt. It was crowded with apparatus which was meaningless to Hart. A couple of technicians stood by, smoking and talking and most infernally casual about it all.

"Well," said the doctor, a little awkwardly, "I guess this is it. Are you sure you don't want to leave any farewell messages or—?"

"No," said Hart. "I hate goodbyes. I've said mine, and don't want that railway-platform waiting at the end. Let's get it over with."

"O.K. Mount that plate over there, please, between those four big coils. And—good luck." The doctor extended his hand and Hart shook it, thinking to himself that it was a wholly unnecessary gesture. Maybe they'd have better taste in the future.

He climbed up onto the silvery disk and stood looking out between coils that were taller than he was. His knees were a little weak—almost, he was temped to shout, to call a halt— But that would be silly, of course.

The technicians busied themselves about the generator with that casual competence he had always found irritating in their breed. He heard the list of instrument readings called out, someone else said, "Check," and he thought briefly and wildly, *Maybe it's also mate.* A switch slammed down and a blue glow hovered over the coils. He heard a low, rising hum.

It faded. "Alri, no," said the doctor. "Du can downstep no."

Hart had a moment where his mind wobbled, where he thought wildly that it hadn't worked after all. Great Heaven, he was still in the world, still at home—

What had happened to the doctor? Where were the technicians? These weren't the same men they had been an instant ago!

An instant—no, an age. There was no time-flow in the stasis field—he was in the future.

He had thought himself mentally prepared. But it was too sudden. The shock was too blurringly great—shattering, devastating shock of suddenly alien men, alien speech, alien world. He staggered a little, and the doctor stepped up on the platform to support him.

"Taak it aisy no," said the stranger soothingly. "Are shock, I knuw. But du are mung towarishes no."

Hart leaned on the man's arm—a big, solid fellow, which was somehow reassuring—and let the soft, lilting words slide over the surface of his mind. Almost, they were familiar. For a moment he couldn't follow the speech at all, then he caught words and recognized the

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changes in accent. Except for the foreign terms and the slang, he could follow the language. Certainly he could get the drift of it.

Only—how long would it take to modify the tongue so much?

He almost croaked the question. The doctor said slowly, "Dis are yaar 2837, du would say. But bay chronomizing nos, are yaar 2841."

"What on earth—" The sheer incongruity of it jerked Hart from his daze. He might have accepted a wholly different chronology, but—four years' difference! "How the hell did that ever happen?"

"Hell—" For a moment, the doctor was puzzled, then his face cleared. "Oh, yes, medyaeval belief." He smiled. "Skood du raaly ask huw de Heaven. See du, in sunamed Second Dark Ages Americas waar under rule of de Kyirk of de Second Coming. Dey waar religiofanatics whuw held dat chronomizing skood be set up four yaars since dey claimed Christ waar raaly borned in 4 B.C. bay uwld chronomizing. Bay time yoke of de Kyirk waar overthruwn, everybody waar used to new style."

Hart nodded, a little overwhelmed. "I . . . see—"

It didn't matter, though. It didn't matter. The . . . the Church of the Second Coming was in the past now, the dusty buried past which had still been in the future—ten minutes ago!

Almost nine hundred years. Nine hundred years!

"Here." The doctor gave him a little flask. "Drink du dis."

He gulped the liquid. It was tasteless, but it seemed to lay a great calm hand on him, his mind steadied and the trembling went out of his knees. He looked around him.

The chamber was different. The Crypt was not nearly so full, and it bore signs of extensive repair work. Many must have been released, many— But lymphatic cancer was really a tough diesase, it would have taken time to work out the cure and if ages of barbarism had intervened—

His eyes swung to the men. There were, as before, two technicians and a doctor. (And the three men of *his* time were dust these many centuries.) They were large, well-shaped fellows, with dark hair and skin, eyes with a hint of obliquity, high cheekbones—but, clearly, the Caucasoid strain still predominated however great an admixture there had been. They looked curiously alike, as if they were brothers, and were dressed almost identically—sandals, kilt, and tunic of some faintly iridescent material, with a curious involved pattern reminiscent of Scottish tartans on the left breast. There must have been immense folk wanderings during the dark ages, thought Hart vaguely, fantastic interbreeding and a rise of composite types of man.

He said aloud, slowly: "You have a cure for my case?"

"Of cuwrse, Tov Hart. De uwld records did not survive, but de Crypt and traditions abuwt it did. Su alsuw did de case histories engraved on de

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metal. We are ready for du no. De meditechnics have bee-an perfected uwnly in de last fifty yaars, and of cuwrse we wanted to be shoor we waar right before waking any of de 'sleepers'."

"I seem to be one of the last."

"Indeed, Tov Hart, du are. Case duurs proved more difficult dan had bee-an antsipated. But we have a quick and aisy treating no."

"Well—" It might only have been the stimulant, or maybe the words, but Hart felt immensely braced. He was going to live! And in a super-scientific world of friendly people, he should be able to make his way. His money would hardly have survived all the changes of history, but—well, there must be some provision made for the "sleepers."

The world wasn't such a bad place. Even in the far future, it wasn't bad.

"I'm afraid you have the better of me," he said to the doctor. At his puzzled look, he added: "With regard to names, I mean."

"Oh. Pardon, Tov. We are all Rostoms here. I are Waldor Rostom Chang, here are Hallan Rostom Duwgal and Olwar Rostom Serwitch."

The three men bowed formally. Hart tried to return the gesture, but couldn't quite imitate the slight knee bend and the position of hands and head. "Philip Bronson Hart," he said. "But the middle name isn't the family name, the last is."

"As wit us," said the doctor, Waldor Chang. "Family name nos come last, group name in middle, gived name in front. But dey had not de groupings in time duurs, did dey?" He smiled. "Come du no, towarish, above ground. De clinic are quite nea-ar, and we will suwn have du well."

The landscape hadn't changed much, there were still the same hills and trees, the far shining thread of a river and the wind cool and fresh on their faces. White clouds walked overhead through a sky of sunny blue, and a thrush was singing in a little thicket.

But there were few signs of man. The little village which had once been visible down beside the river had long since moldered into the earth, and the buildings of the Crypt center were gone, replaced with a single-roomed frame hut over the vault itself. Above the trees Hart could see a structure of stone and sun-flashing glass which must be the clinic, but otherwise there was no trace of civilization.

"This region must have become pretty well depopulated in the time since I went to 'sleep'," he remarked.

"Why, nuw. It are raader heawily settled," replied Chang. "Dere must be-a, oh, all of a million people witin a radyus of a tousand kilometers."

"But— That's less than— How many people are there in the country?"

"About tirty million in Nort America. Or on all Eart, abuwt haaf

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a billion. Of cuwrse, dere must be-a a good ten million on de oder planets of de Solsystem, and perhaps anoder haaf billion in Centaari and elsewhaar—but little are knuwed abuwt dat."

"But—in my time, there were over two billion people on Earth!"

Chang gave Hart a quizzical look. "Su I have heared," he said slowly. "But times have cha-enged, Tov. It may taak du some while to reelayze huw much dey have cha-enged."

They entered the clinic. A blond young woman who was apparently a nurse stood waiting for them. She wore a crisp white skirt, and nothing else, and she was gorgeous.

She and Chang gave their patient an examination which for thoroughness surpassed anything in his time. He didn't pretend to understand the machines that buzzed and clicked and glowed around him, the serological tests and the curious symbolic notation. But he hadn't expected to—naturally, medicine would be far advanced, and he hadn't troubled himself to learn the details even of the past techniques.

"Very good," said the doctor at last. "Satisfactry reactions tuw virus Beta, good Delta cofficient—yes, we skood suwn have du well, Tov Hart."

"What's the cure?" he asked idly. "In my time they were beginning to think there'd never be a specific for cancer."

"Dere aren't, but dere are specifics for de difrent kinds. Artficial diseases have bee-an developed which attack uwnly de disorganized cancer cells. Frinstance, for cancer of de liver we inject a disease of de liver, but one which healthy tissue can resist. De sick cells are eaten away sluwly enough so dat normal tissue gruws back to replace dem as dey disappear. It are more complex dan dat, of cuwrse, but dat give du de genral idea-a." He smiled. "A mont or su in hospital skood suffice for du, and we can give du de oder tests in de mea-anwhile."

"The . . . other—?" It sounded faintly ominous.

"Classficating and su on. Worry du pot abuwt it no."

"Come du," said the nurse. "I will taak du to ruwm duurs."

Hart followed her to an elevator. It went up with a pleasingly low acceleration, but his pulse went a little fast just the same. She was exciting!

"What's your name, please?" he asked. He put on the smile which had usually worked in the past. "We'll be seeing a lot of each other, I hope."

The girl frowned, then seemed to make an allowance for him. "Mara Sorens Haalwor."

"This is a pleasure . . . you're not married?" Hart edged closer.

"Mayried? Oh, de uwld style. Nuw, but—" She backed away. Her face bore an expression of distaste, barely covered by politeness. "Please du, Tov Hart—"

"Oh. Sorry." Hart moved from her, a little chapfallen. Oh, well.

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He had a room to himself—he found out later that all hospital patients did—which delighted him. It was large and sunny, more like a living room than anything else. The furniture was curious, rather hard and low-legged—Asiatic influence during the dark ages?—but he could get used to that. There was a set of buttons on the wall which he learned how to use when he wanted to read. Central "libraries" had all the books and music in existence, no one owned volumes or records privately any more. To read anything in existence, one simply called the nearest "library" and asked for it; automatically, the books—actually, record tapes—were flashed onto a screen, the speed being regulated by the reader. Likewise, any music was played directly into the citizen's own room. There were enough copies of all record tapes to take care of any reasonable number of simultaneous requests, and if a local "library" didn't happen to have a certain item it would be relayed from one which did.

Curiously, there were no movie records, and no regular radio or television programs. Hart was too busy catching up with history and language at first to wonder why.

His synthetic disease and the physiological strain of growing new tissue left him a little weak, he stayed close to his room and only went out in the hospital gardens on orders of the staff. Nor did he have any visitors except the medical workers. After a while, he began to be lonely.

He was put through a series of

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psychological tests more exhaustive than the physical checkups. Here, too, he was baffled by the intricacy of a science evolved immensely beyond the older one which itself had puzzled him. Some of it was recognizable—word-association, elaborate questionnaires much of which seemed to be completely irrelevant, long informal talks with a psychiatrist. And the huge machines which studied him seemed remote descendants of the electroencephalographs he had known. But he went through completely bewildering processes—hypnotism, drugging, physical exercises.

"What's the idea?" he demanded, a little indignantly. "You seem to want to know me better than I know myself. Why?"

"Psychoclassficating," said the tester. "All citizens undergo it, with periodic rechecks."

That sounded ominous. *What kind of totalitarian state have I landed in?* "What do you do with the results?"

"Counsel, advise, straighten uwt conflicts. And, of cuwrse, arra-enge introductions." The psychiatrist looked troubled. He kept looking at the elaborate data sheets in his hand, as if he couldn't quite believe what he saw. "Suwcial integating of individual depend on what psychotype he are, Tov Hart. No, if du will excoose me, I must study dese results—"

Hart went back to his reading. He was having trouble finding out what kind of world he lived in. There were plenty of histories, but they said little about the details of daily life, and they grew remarkably uneventful as they neared the present time. There were also plenty of sociological texts, but these were written in a technical language that left his head whirling—much of the material, indeed, was mathematical. He recognized the symbology as descended from the symbolic logic and calculus of statement of his own time, but since his acquaintance with those had been completely superficial that didn't help much.

But manners, customs, family relations, all the million little details which make up life—rather than the abstractions of life, such as history and sociology—were nowhere explicitly described. After all, why should a people concern itself with its own mores? Such things are learned in childhood, are absorbed unconsciously as the individual grows through life. Had any twentieth century anthropologist ever described the habits and customs and beliefs of New York as carefully and objectively as he did those of the upper Congo? Hart found himself in the curious position of having learned more about the social organization of the natives of Procyon IV than those of Sol III.

He went back to history. That he could learn objectively, and with such a background feel his way around contemporary Earth until he learned the social ropes.

But it bewildered him. It had no

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feel of reality to it, for it was not part of the matrix which had produced him. The Church of the Second Coming,—the Asiatic invasion of America, the mechaniolatry of the Australian Reformers, the invasion of Luna by the weirdly changed descendants of Earth's old Martian colonists, the Scientific State, the Overthrow, the retirement of the Dissenters, the evolution of the family groups— Well, what was it? A story, a dream which had passed by while he slept, the thoughts and deeds and struggles of men unthought of in his own age.

Napoleon had been an almost living reality to Hart. He had read Emil Ludwig, he had listened to *Die Beiden Grenadieren,* he had heard all the tired old jokes about crazy men with hands in their coats, he had been subjected to the wistful reminiscences of old men who had grown up in that forever lost world which came between the Congress of Vienna and the murder at Sarajevo—he had, without being unusually interested in the Corsican, lived in a world where the little man had been a dominating influence even a century after his death. Napoleon was as much part of his background, part of the complex of events which had, *inter alia,* produced Philip Hart, as the sun or the moon or the banging canyons of New York.

But could an imperial Roman transported to the twentieth century *feel* that a defeated dictator of a hundred years ago had existed? Would Napoleon be more than a dusty fiction? Would the Roman consider it logical that Frenchmen should be below the average European height, that the French law should be completely revised, that the Louisiana Territory should be American and Haiti independent, that the Nelson column should rise in London, that the whole existing world should *be,* all because of one little *condottiere?* The Roman might realize the fact, with the top of his mind, but it would not look reasonable to him. Because *he* would not be one of those inevitable results.

Hart gave up trying to make more than superficial sense out of all that had happened since the twentieth century, and simply learned the salient facts. He got a rough outline of the present political and economic status of man.

Earth—and the Lunar cave-cities—were under one rule. The colonists on Venus, Mars, and the outer planet satellites had evolved their own societies, often radically different from that of the mother world; man himself had had to become modified before he could settle the reaches of space, an evolution which had been carried out by the eugenics of the Scientific State with ruthless completeness. There was still regular interplanetary contact, but it was infrequent. The different branches of man had too little in common by now. Once in a great while there would be a ship from one of the colonies on the nearer

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stars—but distances were too great, even Alpha Centauri was fifty years away, and social evolution was diverging out there.

But could it be said that Earth was—ruled? Not in any traditional sense. The social organization was uniform, and a single council did what little administrative work the planet required. But there was nothing like a real government. History—wars, social changes, migrations, important new discoveries and concepts, events of any great significance—had been slowing for the last three centuries, ever since the family-group society had gained the ascendancy. For the last hundred years or so, nothing had really happened to mankind as a whole. *Nothing!*

It might be called a philosophical anarchy. Superficially, there was perfect freedom. The general law had almost no regulations on individual behavior. There was, apparently, universal content.

Decadent? No—not in the usual sense. These people were too magnificently healthy, too full of life and laughter. But they were certainly not progressive.

Hart tried to make time with the nurses, and failed completely. They were all frigidly polite. The male staff members were cordial enough, but there was an inward reserve which increased with the days. Hart wondered what was the matter. His unhappiness waxed with his returning strength.

Chang came in at last. "I think du can leave clinic no," he said cheerily. "Du have best undergo perodic checkups for a yaar or twuw, but all medics are shoor du are guwing to recover completely." He handed the patient a set of clothes like his own, but without the group insigne.

Hart got out of the hospital robe and climbed into the garments. "And now what?" he asked. "I've tried to pump everybody on what I'm supposed to do, but they're all so evasive I haven't really learned a thing."

Chang looked uncomfortable. "We have place for du," he said. "It have taak unusually long time to analyze psychometric results duurs. Dey are su very different from ordinaary."

"Well—" Hart waited impatiently. They'd been stalling him long enough.

Chang explained as well as he could. Psychometry and preventive psychiatry were really the basis of society. The fundamental personality of the individual was determined at an early age and he was "developed" throughout life in accordance with that—conditioned to society, but not in such a rigid fashion as to interfere with really basic urges. Vocations, recreations, social life, were all planned in accordance with psychometric data.

"Planned?" exclaimed Hart. "How on earth can you plan everything?"

Well, not exactly planned either.

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Guided. An individual had such and such an I.Q., his main interests were so and so, his personality factors were as follows—it all went into a great electronic "file", in the powerful psychosymbology of the time. And any citizen had access to that file, with technicians to help him in its use. Thus you could find your likes, your associates, wherever they might happen to live, rather than leave it to chance encounters. It was scientifically predictable whether a friendship, a marriage, a business association, would be really of mutual profit. Naturally, everyone made use of the service, and adjusted his life accordingly.

"But—ye gods! You mean *anyone* can find out all about you at any time? What kind of privacy is that?"

Privacy? Chang was puzzled now. The word still remained in the language, but it had come to mean simply solitude. Why should you care whether or not anyone else knew just what you were? It didn't make you any better or worse, did it? You could find your kind in the world, those whose company was most pleasing to you. You could know yourself, and set your goals accordingly—you could change most really undesirable characteristics, with the help of psychiatry or even of endocrinology and surgery.

The "groups", originally simply clans formed for mutual protection, were increasingly becoming endogamous associations of similar people. It was the group which was the real unit of society. Business, social life—all were integrated with the needs of the group, and of the world as a whole.

For instance, it was desirable that population be limited. Overpopulation was probably the most basic cause of misery in past history. Thus the group council regulated how many children there should be in a given family. It decided how long a marriage—family association was the term now—should last; a person might have children by three or four different people, if that seemed to be for the good of human evolution.

"But—suppose your individual doesn't want to obey? I noticed nothing in the law compelling him to."

"Obedience are customary, and psychoconditioning in childhood delibraatly plants reflexes of conformity wit custom. No sane person *wants* to do oderwise."

"But . . . but . . . talk about tyrannies!"

"Why, nuw." Chang was taken aback at Hart's violent reaction. "All societies in past conditioned young. Waar du not telled to obey law and worship flag—dey still had flag-worship in time duurs, did dey not?—and how it are wrong to kill and steal? But such conditioning waar superficial, it did not always affect basic impulses, so dat dere waar tragic conflicts between individual needs and desires and de laws and customs. Frustrating, crime, insanity! No wonder de dark ages came. Today we simply condition

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so thoroughly—and de inculcated desides do not conflict wit basic instincts—dat no one wants to break rules which fit him su perfectly."

"Everyone?"

"Well—dere are exceptions, ewen today. If dey cannot be adjusted, or will not be—since noting is legally compulsory—dey must eider be sent to space colonies or struggle trough an unhappy life on Eart, witout friends or marriage, witout ewen a group. But numbers deys gruw less all de time."

"Hm-m-m . . . well—"

"Ewerybody have his place in society. Ewerybody happy wit life, nobody have conflicts wit felluw man—dat are goal nos. And we are close to it."

"It sounds nice," muttered Hart. He shrugged. "Not much I can do about it, anyway." His eyes swung back to the doctor's. "Now what about me?"

"Well—" Chang was obviously steeling himself. He smiled with a false geniality. "Well, we have seweral possibilities. Dere are a weader station in Greenland, or a small farm in Brazil, or—"

"Hold on!" Hart reached out and grabbed the doctor's tunic. His throat choked with a sudden rage and, under that, a gathering horrible dismay. "What do you think you're doing? Am I going to be stuck somewhere out of the sight of man and forgotten?"

"I—"

"Come on," snarled Hart. The fist he lifted was shaking. "Spit out the truth or you'll be spitting out your teeth."

Chang disengaged himself and held the smaller man with an effortless strength. His face was twisted. "I . . . I are sorry, Tov Hart," he said, very quietly. "It waar raaly a cruel kindness to wake du. But I are afraid dat—du are right."

Hart sagged, the anger draining from him and leaving only a vast hollow void. Dimly, he heard Chang's voice: "Du have nuw place in world. Du belong to nuw famly or group. Du have no traits wort perpetuating—indeed, we would not want children wit cancer tendency duurs. Psychotests show du as unstable, egocentric, unable to adjust to cityless world, to close familial relationship, to . . . anything. No one would want to associate wit completely unintegrated, hopelessly neurotic . . . foreigner.

"Best du find a quiet place where du can serve . . . out of sight."

Hart rebelled. Bitterly, desperately, he tried to escape. There must be—something. He had been the admired leader of his little clique. Broad knowledge, sardonic humor, a way with women, ready money, all had combined to impress and delight. Surely the world had not changed so much!

No compulsion was put on him. He went where and when he chose, he spent a good three months prowling this new Earth, riding the free public transport and using an unlimited government credit card to buy

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necessities. And he found that the world had indeed changed.

The tall, healthy, serene folk were polite to him, and no more. But they had nothing in common with him. He belonged to no group and, for eugenic and other reasons, could not be adopted into one, and all social functions were within such alliances. He did not follow their jokes, his manners were gauche compared to the formality now accepted, his learning and background were from a period too remote to interest any but scholars. There was no underworld, no demimonde. Morality was somewhat changed, but it was never violated.

For his part, Hart began to be bored. It was not entirely a subjective attitude rising out of resentment at inferiority. These people were slow-speaking, formal, calm, they lacked the tension and the acrid mirth of the twentieth century. They were not weaklings in any sense, but they were—innocent.

There was no entertainment except what groups provided for themselves—singing, dancing, amateur showmanship, a great deal of hobbycraft. The reason for the absence of professional entertainment was basically the same as that for the lack of large-scale industry. The group society was deliberately throwing the individual and the family on their own resources. Now that there were no external challenges of war, poverty, famine, disease, now that history had slowed almost to a standstill, man must return to a degree of primitive self-sufficiency, and independence if he was not to become the glorified termite inhabiting a purposeless machine city.

Hart saw the reasoning, but it seemed puritanical to him. And he could not sympathize with a people who deliberately submitted to it. A man who plowed his own fields when science had advanced to the point where everyone could eat out of cans was a fool. To be sure, the man was conditioned to like it, and certainly the food was better than the sterilized pap of twentieth century canneries—but even so—

Hart tried to leave Earth altogether. But he lacked the physique and the technical skill which would justify a spaceship in hauling him. And from what he read of the spatial colonies, he was likely to find a still more alien society out there.

In the end, desperately, he took the weather station job.

For a while that was better. He was alone, away from the subtler and crueler isolation of strangers' company, and he was not entirely useless. The vast windswept snowfields, the far mysterious glimmer of northern lights wavering over enormous mountains, the snug hut where he had access to the books and music of all history, were all somehow comforting. He barely spoke to the pilot of the occasional supply rocket, and refused to be relieved.

He couldn't go back to a world which had no use for him. He could stay here and dream of what had been, out here in the wind-whining

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loneliness, alone in the dark with the ghosts of his own time whispering to him—

They muttered on the dark corners, they wavered in the auroras and the pale cold sunlight, ghosts of the past, calling to him over a gulf of time. Time began to be meaningless, and space. In this unreal landscape of ice and snow and dark, wind blowing up between the frosty stars, it was hard to say where the solid world left off and the dreams began.

Hart realized vaguely that he was slipping. But it didn't matter. Certainly he couldn't return to the politeness of the world, more cold and remote than the flying haggard moon, he couldn't leave his old friends here— Why, his relief would sweep the dust out of the cabin, dust which had once been human, dust which had once lain in his arms or laughed at his humor— Now the wind laughed, hooting around the house and rattling the shutters in appreciation of Hart's jokes.

Waldor Rostom Chang looked, with horror creeping behind his eyes, at the thing which mumbled on the floor of the airjet. Hart was almost completely catatonic now.

"If we had knuwed!" said the doctor. "If we had uwnly knuwed!"

"How skood we?" asked the pilot, a weather service technician. "De job waar just 'made' work, to give de poor felluw someting to do. Reports his waar filed in de waste-basket. And he had bee-an su unsuwciable dat de supply pilots simply left stuff his witout ewen seeing him. It waar uwnly when he had quit reporting for seweral days dat we got alarmed."

"I newwer drea-amed he would go crazy, ewen when he had bee-an dere two yaars witout relief," said Chang. "After all, a modern man could stand it easily. And de twentyet century mind waar too strange to mind nos, completely unintegrated as it waar, for de psychotechnics to spot de instability in him."

"And nuw what will we do wit him?"

"We cannot help de poor jorp. Psychiatry nos are preventive, mental disease su long forgetted dat we have no real curative technique—teories, records of old cure-metods, yes, but nuw experenced mental doctors." Chang shrugged. "All we can do is put Hart back in de Crypt till such day as psychiatry have evolved cure for su extreme a case as his. And dere are su little need for psychocuring today dat I fear it will be a long, long time befuwre Hart can be outtaken again."

The pilot grinned mirthlessly. "By den," he said, "society may be su alien dat Hart, once cured, will relapse into insanity too deep for dem to handle—so dey will have to put him back in de Crypt—" He spied his goal and sent the airjet slanting downward.

THE END

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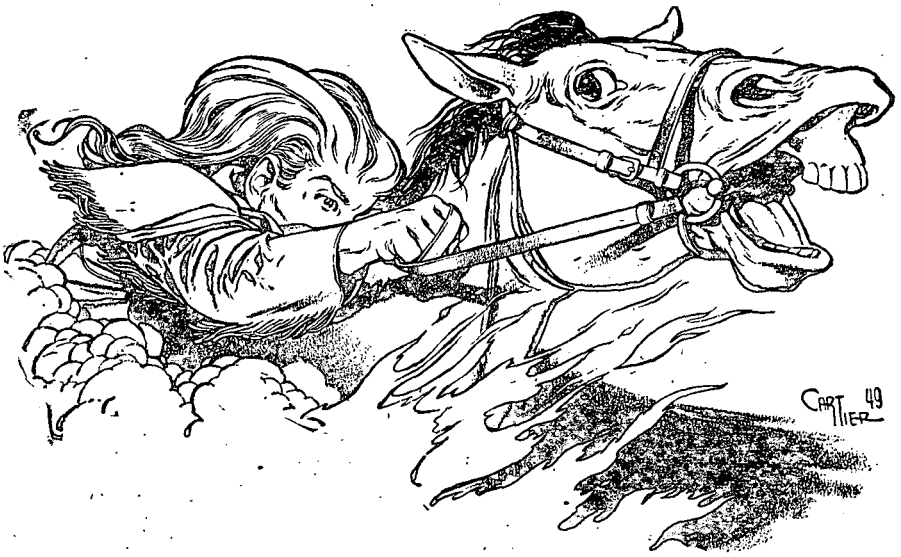

THE AUTOMAGIC HORSE

BY L. RON HUBBARD

The only professional miracle-makers today—to whom making science-fiction come true is a run-of-the-mine assignment—are not in laboratories. But there was one who wanted that lab—

Illustrated by Cartier

"It ain't the principle of the thing, it's the money," said Gadget O'Dowd. "The day when I can build you a reasonable facsimile of Man-of-War for ten thousand dollars, I'll know recession is here!"

Mike Doyle, the assistant chief of the Technical Division of the Property Department of United Pictures, slumped sadly behind his desk, looking at Gadget. Ordinarily they were friends but they had reached an impasse. Mike prided himself upon an ancestry which included somebody who had kissed the Blarney Stone.

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"Gadget," said Mike, "we pay you two thousand dollars a week to be a construction genius. Look at what you've done in the past. And now you're trying to balk at a lousy little old mechanical horse."

Gadget reached into the pocket of this ninety-dollar sport jacket, pulled out a thousand-dollar platinum cigarette case and offered Mike one of his special-made smokes. Mike refusing, Gadget lit his own with a diamond-studded lighter. He smoked pensively.

Gadget was slender, red-headed, snub-nosed and Irish. He was trying to look frank just now but for all that he could not quite hide a single fact about himself—he was a man who harbored an enormous secret.

He had been christened George Carlton O'Dowd and he had enough university degrees to comfortably paper a large office. He could have been the chief of any number of vast epoch-making research organizations but instead he was an effect specialist for United Pictures. The reason was highly classified. And it demanded money.

"This budgeteering will ruin me yet," said Gadget. "It is getting so a man can't make a dishonest dollar unless he's first cousin to the president of this company. I can't make a horse that will do what you want unless you up that budget. And that's final!"

Mike Doyle got up and sat down again on the edge of his desk. He was earnest and persuasive. "Now listen, Gadget, have a heart. I can't help what these men in the upper echelon are trying to do. They give me my assignments and tell me what I am supposed to do. And that's that. Look at the spot we are in. The script says here"—and he tapped it—"that Miss Morris has to gallop a horse out of the middle of a burning barn, bust through the doors and escape from Peter Butler who's got the place ringed with his gunmen.

"Now, Gadget, you know dog-gone well that The Society For The Prevention of Cruelty to Animals ain't going to let us use no live horse. This scene has gotta be big, with lots of flame, and the roof caves in immediately after the stunt man gets out of there. Now if he didn't get a chance to batter the doors down and the roof fell in and it was a live horse we was using, the S.P.C.A. would be down on us like a load of block-busters. You just plain got to give us a decent horse. You know what happened to 'Diana And The Devil'?"

"No," said Gadget, disinterestedly, "what?"

"Well, that little dog they used in there that was supposed to rescue the kid out of the duck pond up and got pneumonia and died. The S.P.C.A. got Ladies Aid Societies all over the country to ban that picture. It must have cost us a million and a half. Gadget, you just got to get us that horse!"

"If the Wall Street boys upstairs want to give a dog pneumonia and lose a million and a half that's their

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lookout," said Gadget. "I've got to think about my overhead."

"And you got to think about your old age," said Mike. "I'll tell you what I'll do, I'm a friend of yours, I'll call up McDonnell and see if he won't stretch that budget to fifteen thousand."

Gadget waited while Mike had his secretary put through the call. McDonnell was in the studio barber shop and it took two or three minutes to reach him. Gadget fidgeted while Mike talked.

"But you know how it is," Mike was saying. "I tell you, Mr. McDonnell, even horse meat has gone up. The special-effects man is in here now and he tells me that it can't be done for a cent less than twenty thousand bucks." There were long silences interspersed with grunts from Mike. He occasionally winked at Gadget. "All right," said Mike. "If that's all you'll do, that's all you'll do. I know you got people on your neck, too. All right, Mr. McDonnell. Yes, that's picture business. Good-by sir." Mike hung up and turned to Gadget.

"I got it up to eighteen thousand dollars. If you can't do it for that, we'll have to use stunt men in a horse skin."

Gadget threw away his cigarette with sudden decision. He was all lightness and cheer now. He had expected fifteen thousand dollars as a top figure. His head was already working with plans of what he would do to that horse. He patted Mike affectionately on the shoulder and went out. He gave the secretaries a few wicked winks as he passed them, and he started whistling the moment he was out in the sunshine.

Hands deep in his pockets, Gadget sauntered on down toward the gate. He was just veering off course to pick a carnation from the Stage Six garden for "The Buccaneer" when he heard his name excitedly called behind him.

He turned to find himself pursued by Mike. He sadly shut his mental ledgers.

"Just a minute, Gadget," said Mike, out of breath. "McDonnell must have got kicked around in the front office. He called back to say that he'd have to put an accountant on the job with you."

"An accountant!" gaped Gadget, his snubbed nose getting belligerent.

"I can't help it," said Mike. "Things are getting tough all over."

Gadget finally shrugged, "Well, that's picture business. So long, Mike." And he wandered toward the gate, the carnation forgotten, gloom overcasting the sun.

Tony, his gardener-butler-chauffeur, a weasel-faced little man who played gangster parts whenever Central Casting could find him in its enormous files, popped out to open the door for him.

"What'sa matter, Gadget?" said Tony.

"We have an accountant coming up to hold a club over our heads," gloomed Gadget. "'Don't use so much ink.' 'You've used up your

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allotment of screwdrivers for Tuesday,'" mimicked Gadget. "'I'm sure two drops and not three drops of machine oil would do just as well.' Blah! Picture business!"

"Things could be woise," said Tony, popping in back of the wheel and sending the Horch sports phaeton out through the gate like a lightning bolt. "I picked up two bucks on 'Roamin' Baby' in the fifth at Santa Anita."

"Don't mention horses to me," said Gadget, and he sank down to glare at the sides of Cahuenga Pass as they ripped by.

The studio would not permit Gadget to have his laboratory on the lot since it had twice blown up, menacing, they berated him, "the lives and properties of United Pictures," to say nothing of the last blast's having knocked the toupee from a producer's head at an extremely unpropitious moment.

They had bought him a slice of Sherman Oaks on the theory that the people who lived around there didn't matter and that a range of hills between their special-effects man's dabbling and the property of United Pictures was a fine thing to have.

The Horch phaeton sliced on up Ventura Boulevard past Repulsive Pictures at Laurel Canyon and careened into the exclusive side road which led to Gadget's personal domain. When they screeched to a halt at the door, old Angus McBane, complete with blacksmith's apron, tobacco-stained walrus mustache and a paint advertising cap, was on hand to hear the news.

McBane and Tony Marconio made up Gadget's "family." Angus was a Scotch master-mechanic who had been re-educated, much against his will, by Engineer O'Dowd. In return he had done considerable educating of his own. Angus could make anything from a ladies wrist watch to an atom bomb, providing Gadget gave him the general details.

"I suppose ye've failed," said Angus.

"Nope," said Gadget, getting out and looking speculatively at his laboratory. "They upped it to eighteen thousand."

"Aye?" said Angus, hastily hiding his surprise. "But I suppose there was many a string attached to it?"

"There was," said Gadget. "We have to take on an accountant."

"An accountant!" cried Angus. "Ye mean I'll have to account for every measly wee bit of tin, and cut the corners, and save string?"

"I'm afraid so," said Gadget.

"It isna worth it, laddie. Where and away noo will we be getting the new wing for the shop?"

The three of them looked at the low rambling structure. It was painted white and had window boxes. It appeared to be as innocent as any rose-covered cottage. But this laboratory ran back into the Hollywood Hills for a good eighth of a mile. Its chambers and rooms were equipped with all manner of

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scientific bric-a-brac. The projected left wing was a long spur which would go underground far enough to permit an experimentation with gamma rays. It costs money to drill solid rock, particularly when it has to be re-enforced against possible earthquakes. They had counted on this present job to complete the drifting.

"Let's all go in and have a drink," said Gadget. And they sadly filed into the main room which was a combination bar, museum and lounge. Tony mixed up three buttermilk flips, since the alcohol on the shelves behind was strictly for visitor consumption, by common consent.

"I know he tried," said Tony.

"Well, I didna expect any more," said Angus, wiping the buttermilk from his walrus mustache. "Noo chief, what onerous task begins this sad travail?"

"Well, it's got to be a horse," said Gadget. Something like inspiration came into his eyes. His stature grew. His red hair glowed. "It's got to be a horse that will run and buck and break down a door and be fairly fireproof. I think maybe you'd better start in with a hide."

He was thinking now. Like an artist who begins to conceive a great masterpiece, he forgot the financial worry and his own current project in the joy of pure creation. "I'll take care of the skeletal structure as soon as I can get to the drawing board. There's a plate of a horse skeleton around here some place. I'll use that new alpha battery motor we built for 'Frankenstein's Mate.' But the thing is, it has got to look real. It has got to act real. It's got to be a masterpiece! Angus, first thing you do is find a hide. I'll fireproof it; you just find a hide."

"Who's going to fireproof the stunt man?" said Tony.

"There isn't any S.P.C.A. for stunt men," reproved Gadget. "Now Angus, you get out and find me a horse."

"We canna kill it," said Angus. "There's no difference between murderin' one and burning another."

"Well now, don't bother me with petty details," said Gadget. "I'm thinking. You just get out and find me a good horse hide, head, ears, everything. We can use that blind man radar from 'The Bat's Return' for his eyes. Now let me see—"

Angus hung up his leather apron behind the bar, removed his paint advertising cap and got into an old tweed coat. "How much'll I pay, laddie?"

"Steal it if possible. When that accountant gets here we'll tell him—"

A cool voice behind them said: "You'll tell her what?"

They whirled to find themselves looking at a girl who could have been a stand-in for Hedy Lamarr. She was beautifully gowned and coifed. She had everything about her to add charm and femininity which Hollywood could devise. But for all that there was a grim precision which came from something

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unseen. It made her, as Gadget estimated in the first glance, about as lovable as one of his special effects for 'The Ghost Rider.'

"I am Miss Franklin, from the front office," she said, extending her hand.

Gadget took it as though he expected it to carry thirty or forty thousand volts. "That was just a joke," he said weakly.

"I'm sure it was," said Miss Franklin. "At least I hope so. I have been looking over your budget and various expenditures, Mr. O'Dowd. The office has warned me to be very careful."

"Have some buttermilk," said Gadget hastily.

"Dishonesty," she announced, "is a thing I cannot tolerate."

"Miss," said Angus, bristling, "this lad dinna have a crooked hair on his head."

"Well," said Miss Franklin, "I shouldn't think it would be necessary for a man who already draws two thousand dollars a week."

"Miss," began Angus, ends of his mustache sticking straight up, "I—"

Whatever it was he would have said was drowned in a clank and roar from the far side of the room. Tony, behind the bar, had pressed a remote control button and now the Moloch, used in the "Lost Tribe", with a yard of flame shooting out of his face, stepped away from the wall with a sound like scrunching bones. He reached out his arms toward Miss Franklin.

Any normal human girl, as they had many times in the past, would have fainted then and there. But not Miss Franklin. She cuffed Moloch soundly on the jaw and sat him down with a dreadful clatter of jarred parts.

"That was very effective on the screen," said Miss Franklin, "but I think it rather childish of you to keep it around. May I ask where my office is?"

Struck dumb, Gadget escorted her through a door into a chrome and mahogany cubicle which he usually turned over to visiting engineers. He left her to spread out her account books and pencils on the desk. He noted that she did it in a disgustingly precise manner. Now he would *never* make any progress with that gamma room tunnel.

In his own office, Gadget stared unseeing at the rows of pin-up girls which had been drawn especially by his muralist. He did not even notice when Tony removed his coat and slid him into his turquoise working jacket. He sank down at his drawing board and picked up his pencil.

"Well, there's other grafts," said Tony.

"Not that pay two thousand a week," said Gadget.

"Well, you don't *have* to keep on wit' the project," said Tony.

Gadget looked at him, suddenly stricken. Tony recoiled, realizing his heresy.

"I'm sorry!" said Tony. "I know

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what we got to do. I was just kiddin', chief."

Gadget shafted out another glare and looked back at the board. Tony said no more about it. It was, in fact, entirely against the law to mention it around here. But all this slaving and sweating and dollar grubbing was on the highroad to as gallant and daring a project as mankind could conceive. The three of them were dedicated, soul and pocketbook, to an endeavor which would have made even Samuel Goldwyn dizzy.

They weren't going to make a supercolossal epic. They weren't going to overthrow United Pictures. They weren't going to elect a president. No, their dreams had no such finite limits.

Gadget and Company were headed for the Moon!

And after that Mars!

And after that stars!

Real stars. Not boomp girls.

Lying in the labyrinths of this workshop, woven into every plan, staring out of each scheme was the nose of the *Voyageur I*, a spaceship destined to make History!

No two-bit research job for Gadget like chief of Westinghouse Laboratory; no little niche like head of the Army or Navy; no peanut-sized job like the presidency of the United States or the boss of the United Nations. This Irishman had slightly larger plans. He intended to make a test voyage around the Moon and then a full jaunt to Mars. Following which he was going to break the "wall of light" and get out there where they had some *man*-sized planets.

Who would trade the Earth and any job on it for the full possession of some king-sized satellites around some giant class stars? Not Gadget. He was going to give Earth an empire that *was* an Empire and become immortal in the bargain.

Every penny he could beg, chisel or even earn was tied up in the *Voyageur I*. Every one of his experiments was slanted to some improvement of that ship. Actual parts of it were scattered here and there through these laboratories and its full design, constantly modified, was guarded by a safe in the floor so burglar-proof that the F.B.I. in full force couldn't have cracked it.

This was the secret of Gadget O'Dowd and this was the plan to which his "family" was dedicated to the death. Top secret. Top!

Tony tiptoed out of there, knowing better than to say another word. He listened at the door and after a while heard Gadget's sixty-cent fountain pen scratching away at the horse drawings. Tony drew off.

Peeking into Miss Franklin's office he saw her sitting, making entries in her ledgers. He made a face at her back and went out to prune the orange trees. They were very special orange trees, mineralized artificially so as to produce super-orange-juice which, some day, would be condensed and canned for the larder of a spaceship to prevent, at

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one drop per day, any possible quantity of space scurvy.

A chipmunk chattered at him. Tony suddenly drew a gun from an equally imaginary shoulder holster and fired six death-dealing shots at the chipmunk.

"Take dat! And dat, you stinking swine!" said Tony. "I'll massacre— Don't shoot! Don't shoot!" But he was shot and he staggered to his knees to do a fine death scene he had witnessed in a Humphrey Bogart opus last night. Much cheered then, he got up, recovered his shears and clipped away at the twigs. He began to whistle the overture from "Aïda."

The following afternoon an incident occurred which sounded the general alarm loud enough to call both Gadget and Tony from a hasty lunch. They rushed into the first chamber of the workshop where electrical effects were ordinarily made and were startled into immobility by a very strange sight.

Miss Franklin, who, as far as Gadget could find out, had no first name, was there. She was dressed in a lovely afternoon gown with a stupefying pair of horn-rimmed glasses perched on her very smudged nose. Her pencil was poised militantly over a notebook. Facing her was Angus McBane, half-covered by a horse hide which he had been in the act of dragging through the door. Angus saw with relief that re-enforcements were approaching from the other entrance.

"Gadget, she's taking an inventory!" said Angus.

If he had told Gadget and Tony that Miss Franklin had been caught dismembering a new-born infant, they could not have been more shocked. Gadget glared.

"Miss Franklin, I think this is going a little too far. After all, you will find a complete inventory in my office. I am sure everything is on it which is the property of United Pictures. This distrust is heartbreaking. I cannot understand how you might suppose that we would have been so remiss as to leave important objects off that inventory. Now, these chambers are no place for a lady. That equipment you are looking at was used to furnish the dead man's scene in 'The Mad Doctor.' It is rigged to jump a hundred thousand volts between those electrodes. Anyone coming in here is liable to get injured. Then how would I explain to the studio?

"I swear to you, Miss Franklin, that you will find our inventory—"

Her voice sawed into his speech like a sharpened icicle. "Mr. O'Dowd, I have already found twenty-five transformers, seventeen condensors, something which is labeled 'an alpha pile' and nine cathode ray tubes which do not occur on that so-called inventory of yours. I suppose you can account for those satisfactorily?"

Gadget rallied. "They are my own equipment which I have loaned free of charge to United Pictures. I have not said one word—"

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"Mr. O'Dowd, you know very well that we have rules against private property in a studio technical laboratory. It must be registered with the studio. How else could one keep these matters straight? If you have been so slack in registering your own property and accounting for how you came by it, I cannot help but suppose that there are other irregularities. I am afraid that I must conduct an entire inventory of everything here."

Gadget looked as though he were on the verge of a Zazu Pitts swoon.

"And how aboot my ain tools?" said Angus. "I couldna work wi'out them. And they are so numerous that twould take weeks just to list them."

"I suppose you want me to list my driving gloves, too," said Tony acidly. "See here, Boss. You want I should rub dis dame out?"

Miss Franklin looked coolly at Gadget's man. "Corn," she said. "Pure corn. No wonder you aren't even a bit-player any more. For your information, your driving gloves *should* be registered. According to paragraph three, of section five of the accountancy regulations *everything* which is used in the execution of studio business is either the property of the studio, or must be registered with it for proper rental fees."

Gadget instantly brightened. "Well then, Miss Franklin, I fear we shall have to stop work on this horse long enough to carry out the inventory which you will require."

"On the contrary, Mr. O'Dowd, I do not think that will be necessary. I have here a breakdown of past budgets. Checking back to the inventory I find that there are many items included in past budgets which do not appear on the inventory. I would suggest that you get on with your horse. I shall continue the business of protecting United's property. If there is any discrepancy, you can take it up with me later."

Gadget leaned his head up against the door jamb and beat a futile fist against the wall. "Give 'em control of money and you make Czars out of 'em. No wonder the Russians revolted." He faced her again and put out a beseeching hand. "Miss Franklin, I am a scientist. You are an accountant. You are an expert in such matters, how could I help it if I made a few mistakes here and there? You—"

"A hundred and fifty thousand dollars is a lot of mistakes," said Miss Franklin. "But go on with your work. I am sure that after proper adjustment is made on these books, no word of it will reach the studio. But you have equipment here which should be sold and it is up to me to take care of that."

"Ower my dead body," cried Angus. He threw down the horse hide. "Lady or no lady I—"

Gadget quickly stepped forward and slipped his arm through Miss Franklin's. "Let's go into the outer

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office," he said smoothly, and talk this thing over quietly."

Miss Franklin wavered and then reached out her hand for the bill which Angus had been gripping. "I suppose that's the bill for the thing you are carrying?" said Miss Franklin.

Angus surrendered it. And Gadget was able to lead the militant accountant into the main room. He was trying to distract her attention, but she read the bill anyway.

"My," she said, "that's a little bit high for a horse hide, twenty-eight hundred dollars. And he has even added taxi fare."

Gadget looked at it, puckering his brow. "Why see here, he couldn't have a horse killed for the purpose. The only thing he could do was to get a stuffed horse out of the museum. That's natural now, isn't it? See? It says right here at the top, The Santa Ana Museum, stuffed relic of Stardust sired by Man-of-War. You remember Stardust. She was a famous racer. Now you wouldn't expect to buy *her* for a measly twenty-eight hundred dollars, would you? She won a hundred and ninety thousand dollars in just one season. And," he added with some satisfaction, "after she goes through that fire, I'm afraid her hide won't be worth very much."

"Well—" said Miss Franklin, doubtfully, "I am not interested in the cost of individual items but only in the entire budget. I have no wish to obstruct your work, Mr. O'Dowd. I am afraid however, that I shall have to pursue that inventory."

"Please," said Gadget, "let it go until a time when I can help you with it. Many of the items you will find are alive and dangerous. Why just last week we had a truck driver executed by a short circuit in a dinosaur from 'Cave Man'." He got her back to his office and was shortly able to rejoin Angus.

Gadget picked up the horse hide.

"Why it does look like Stardust," said Tony.

"Sure, and it is," said Angus. "Me and the curator was howlin' savage drunk half of the night. Somehow, in the scuffle, Stardust came oot at the seams."

"What will happen to the voucher?" said O'Dowd.

"Whin the studio pays it the curator will pay us back all but the ten percent that's to be his squeeze. After all, this is Hollywood."

"Picture business," said Tony with a sage nod. He followed his two conspirators into the blacksmith's shop where Gadget had already sketched out on the wall the structural devices necessary for the skelton. Angus resumed his apron and blew up the forge so hot that his testing spit sizzled into steam a foot before it touched the fire. He picked up a bar of fine manganese steel, glanced at the skeleton, and began to bend it.

"'Tis a weary time that we'll have with that lassie," said Angus. "Twa nights ago, when I saw the moon, 'twas through trees, and it boded no good."

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The place was soon a roaring smoking mass of sparks and clangs. The automagic horse named Stardust was beginning to take form.

During the ensuing six weeks Gadget O'Dowd was so busy that he had little if any time to devote to his gravity-repulsor. The three test units of this machine and the parts of the main construction lay deep in a hidden and so far uninventoried recess of the laboratory.

Miss Franklin was kept busy paying a stream of engineers and delivery boys from R.C.A., General Electric, and Bell Telephone who brought odds and ends of electronic gear, looked happily at the steed, made suggestions, and went on their way. Every tube, booster and transformer was carefully recorded in Miss Franklin's black book. Meanwhile, she went on about her inventory with a grim little smile. Now and then she triumphantly confronted the badgered Gadget with some new item of his perfidy.

"Now look here," Gadget said one morning when the horse was nearing completion, "you've just got to understand that you are a dame and you don't know what I need around here and what I don't."

"I have nothing to do with that," said Miss Franklin. "United Pictures doesn't care how much equipment you have so long as you are using it or intend to use it on *their* projects. Personally it seems to me that you would be well off to get rid of a great deal of this material. It is terribly expensive and too duplicated for any real use in the future. I think I shall recommend to the front office that we hold an electronic junk sale here."

"No, no," said Gadget, hastily. "When I get time I'll explain to you just why it is that we need every piece of this stuff."

"The explanation had better be good," said Miss Franklin.

"Oh, it is, it is," said Gadget. "But right now I have a horse to finish. Has that taxidermist arrived yet?"

The taxidermist had. He was consoling himself at the bar where Tony had poured him a stiff drink. Gadget took the taxidermist and the drink back into the laboratory and showed him the completed skeletal structure.

"What an odd frame," said the taxidermist, he tapped it approvingly. "Limbs in proper proportion, face structure perfect, and all in position and order. My word, Mr. O'Dowd, the National Museum could use you."

"That's what I'm afraid of," said Gadget.

The taxidermist was shedding his maroon sport coat. "Stretching the hide over this shouldn't be too difficult, providing you haven't made it too large."

"Can you make skin flexible?" said Gadget. "That's the one problem that I haven't been able to lick."

"Oh, quite, certainly. I have some preservative oils here. But why should you want it flexible, Mr. O'Dowd?"

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"Oh, just a whim of mine," said Gadget.

The taxidermist had picked up the skin and was again examining the skeletal structure when, for the first time, he beheld the enormous maze of batteries, relays, tubes, antennae and electrical bric-a-brac which filled in the horse's head and barrel. It had been covered with paper to keep out the dust and he had thought that it was just stuffing. But when he pulled the paper away there was the amazing mass of wires and tubes. He backed up as fast as if Frankenstein's monster had just jumped him.

"My word!" he said. "Are you sure it isn't intended to explode?"

"Not a bit of it," said Gadget. "Now let's get down to the business of skin-stretching, what?"

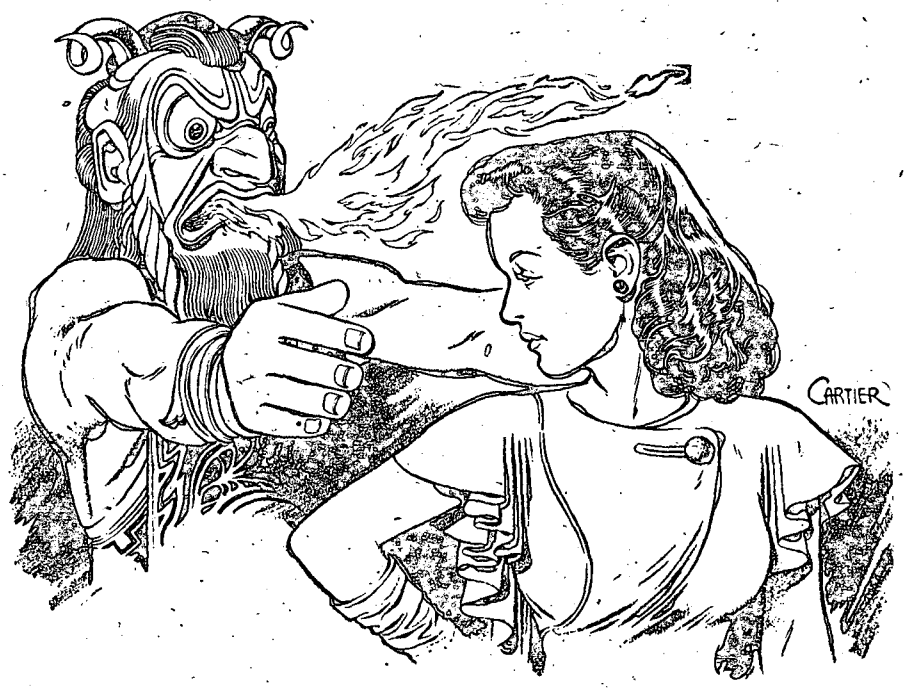
The taxidermist put on his saffron working coat and went solemnly to work, rehabilitating the head and hide of Stardust. Gadget puttered with the adjustment of some final sets in the interior.

"Now, cover up all those seams," said Gadget, "and make sure all those joints will move without cracking the skin."

"Move?" said the taxidermist.

"Move!" said Gadget.

"Well, my word," said the taxidermist. "This is the first time I've



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ever had this kind of a job. Well—that's picture business."

"Picture business," agreed Gadget, nodding. Then he shoved his head deep into the maze of guts, busily setting the remote dials.

Angus McBane came in from the forge room and put a hot rivet through the tail-moving mechanism, which completed his work. He stood back and took a big bite from a plug of Brown's Mule chewing tobacco and expectorated expertly clear across the room into the automatic-situating cuspidor they had had to build on a temporary loan of their services by United to Universal. The cuspidor located the brown projectile by means of a radar beam and rolled noisily and hastily to get under it.

The taxidermist, catching this movement out of the corner of his eye, started back and gaped at the spittoon. He rubbed suspiciously at his glasses and then hesitantly went back to work.

Angus did it a second time and the cuspidor clanged mightily to fulfill its mission. The taxidermist, this time, was alerted for it. He leaped as nervously as the spittoon.

"Whust mon!" said Angus. "Hae ye never seen a trained goboon. Back to ye're work, mon. Ye'll take care there with whut ye're doin'. 'Tis a dangerous beastie ye're workin' upon. One loose seam or an onnatural-fixed hair and he's like to explode with a most terrible bang!"

With this, Angus spat once more and went away to work happily upon some part of his spaceship.

Gadget finished up some of the remaining set adjustments on the control box and then, bored, wandered out to the outer office to see what Miss Franklin had been up to now. He found a brightly dressed and brief-cased young man talking to the accountant. Introduction discovered him to be Mr. Jules Weinbaum, first cousin of Artemis Weinbaum, producer of "Queens in Scarlet," the picture for which the automagic horse was intended.

Naturally, Mr. Weinbaum had insurance to sell, and naturally Miss Franklin was buying it.

"Well, it's all cared for now," said Mr. Weinbaum. "I understand that you've almost completed the property, Mr. O'Dowd. I wish you a great deal of success with it." He shook hands again, ceremoniously, and went outside.

Miss Franklin filed the policy. "Now just because it's insured," she said, "don't get careless."

With some heat, Gadget retorted, "You look after the dollars, Miss Franklin, and I'll look after the property."

"Well now," she said, "why be angry. I am after all only trying to do my job, Mr. O'Dowd, and you will admit that your scientific absent-mindedness has caused a great deal of mix-up in these records. If I don't do my job, I'll lose it, and I need it. I need it very badly."

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Gadget looked at her, feeling trapped and not knowing why. This accountant was not content to fight with all the weapons of her profession and the artillery of the front office, she was also using a woman's tears on him. Suddenly furious, he went into the bar and poured himself fully half a quart of buttermilk.

After two days of hard work the taxidermist was at the end of his task. He was a good taxidermist, but then, the technicians of Hollywood *are* superlatively good. It occasioned no comment that the automagic horse was now Stardust indeed, in the flesh once more, unspotted by so much as a speck of museum dust. She was real down to the last hair. Stardust had a big white star on her forehead with flecks of white ranging back into the sorrel which sleekly covered the rest of her. She was indeed a very attractive horse.

Angus came in lugging a hand-sprayer and a bucket. They thoroughly doused her with invisible fire-proofing.

"That's a good-looking filly," Gadget said to the taxidermist. "Thanks for a fine job." He went over to the control box and lifted it by its handle to a desk.

"What do you intend to do with it?" said the taxidermist. "I never mounted anything before that had to have its joints flexible."

Gadget was not paying any attention to him. He plugged in three relays, threw the switch and twisted a dial. Stardust instantly lifted up her head and let loose a shrill whinny, at the same time rearing and pawing air. She faced around and showed the taxidermist both of her front hoofs. That worthy did a back somersault, raced out the door, went past Miss Franklin and only paused long enough on the running board of his car to grab the check which she hastily brought to him. Then he was gone.

"What did you do to that man?" said Miss Franklin, thinking she heard Gadget at the door. But it was not Gadget, it was Stardust going through her first test, which was of course, to batter down doors. The panel gave with a crash and the filly came through into the office, ducked under the front entrance and stood in the yard rearing and plunging.

Miss Franklin lay where she had fainted until O'Dowd found her and revived her. She looked fearfully at the splinters and then into the garden where stood a statute of a horse arrested in mid-rear.

"He does look-kinda real at that," said Tony in appreciation. He and Gadget and Angus had, at this moment, become extremely fond of Stardust.

"Get me a horse trailer," said Gadget, grinning. "I've got to take her out to Santa Anita for a trial."

Miss Franklin made no protest and asked no questions. She promptly got up, went over to the telephone and dialed the San Fernando Trailers and ordered a horse

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trailer. She looked back at the horse as she laid down the phone. Then she looked at Gadget.

"It certainly looks real," she said. "I thought it was going to tear me to pieces."

"Well she didn't," said Gadget, sadly.

Miss Franklin tidied up her hair and smoothed out her rumpled gown. "Well, that's picture business," she said.

Gadget looked fondly at the horse. "Yes," he said, "that's picture business."

Tony drove the Cadillac at a fast clip towards Santa Anita. Gadget and Angus sat disconsolately in the rear seat. Behind them smoothly rolled a standard Hollywood horse trailer, satin-lined, painted a light blue to match the Cadillac, complete with visor, drinking fountain, feed box, and an automatic disposal unit. It was beginning to get dark as they drove down Colorado Street in Pasadena. They were almost there.

Gadget looked at his ruby-encrusted wrist watch. "I don't understand it," he said. "Everybody can rob the studios but us." And he broke the rule which he himself had made. "It isn't as if United wouldn't get the benefit of it. Why, when those headlines hit the papers United will be in about every fourth paragraph. They couldn't buy that publicity for ninety million bucks."

"And they would'na finance it for ten measly cents," said Angus.

"Maybe we can put the squeeze on somebody," said Tony. "If kidnapin' just wasn't so illegal—"

"I don't wish Miss Franklin any hard luck," said Gadget, "but I wish she'd accidentally fall off the Colorado Street Bridge. It's going to cost us a couple of hundred thousand dollars to buy back our own equipment. And after all the trouble we had chiseling it, too."

"How much?" said Tony, shocked.

"Well, ninety thousand so far," said Gadget sadly.

"Maybe we could crack a bank," said Tony.

"Probably have to give up the whole expedition," said Angus.

Instantly he was fixed with glares from both Tony and O'Dowd. And he sank back with some self-satisfaction to a gnaw off his plug of Brown's Mule. The expectoration into the wind-stream splattered the horse trailer.

They wheeled into the gate and made themselves known to the guard. Gadget's studio card immediately availed them of an attendant's services and dispersed the gathering dusk under an onslaught of floodlights.

They stopped the car. The track wheeled away from them in both directions. The grandstands gaped emptily above them. A few hostlers and touts were wandering around the stables in the far distance. Near at hand some belated losers still gloomed at the rail. Two other horse trailers were in sight. Gad-

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get went beyond the starting gate so that his activities would be hidden from view.

Tony scrambled around and opened up the rear of the horse trailer. Gadget set up the control box under the rail. And Angus laid out a set of tools in case any adjustments had to be made. It was their intention to give Stardust a good thorough test. Otherwise, they could very well hold up production on "Queens in Scarlet" for a day or two by a minor breakdown, which item would cost the studio at least a hundred thousand dollars, due to stars' salaries, stage rentals, and other overhead. One lost day's work for Veronica Morris alone would be worth retiring on. Technicians have to be accurate in picture business.

Tony set up two cases of soda and a package of sandwiches. Then he peeled off his chauffeur's coat to don the frontier buckskin jacket which the stunt man would wear in the scene when he impersonated Veronica Morris. This was strictly roccoco. But, as Tony explained, "I gotta get into the mood for the part."

Stardust backed out of the trailer under her own power. She stood breathing quietly and occasionally snorting and flicking an ear, while Angus fixed the saddle on her. It was an English exercise pad about half of the size of a postage stamp. Even so, little Tony's smallness made it seem quite adequate. Tony mounted, located the stirrups with his toes. He spoke encouragingly. Stardust moved her eyes, pawed and moved off with the sideways restlessness of a race horse.

"Pretty good, huh?" said O'Dowd. "I spent two hours last night lookin' at some films of her when she was in her prime. Now watch this."

Stardust shook her head in a huge negative, snorted and cake-walked forward.

"Say, that's pretty good," said Tony. "I remember that. By golly, you got me half-tricked into believin' this *is* Stardust."

"Wul be keerful of her, laddie," said Angus. "When she was alive she brought me nathing but travail and sorrow. I ken losing seventy-five cents on her to that scut of a bookie Finklestein."

Stardust capered and cavorted. Tony had to do a little expert riding to stay with her. But then, this was in Tony's line. In training up to be a bit player he had undertaken almost any sport you could name. He was fully as proficient on a saddle as he was in an airplane. The only thing which kept him from being a stunt man was an irrational desire to go on living in one piece.

Gadget sent the horse down to the starting gate. Without any attention from the operator Stardust was able to find a box and go into it, stopping when she approached the gate itself.

"You are not going to run her?" said Angus.

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"Well, according to the script," said Gadget, "she has to do a two-hundred-yard sprint after she gets out of that broken door. It's all in one shot, to convince the customers. So she'd *better* know how to run. All right there, Tony. Are you ready?"

"Let's go," said Tony. "Shades of Man-of-War, I wish this was a real race."

The floodlights glared down upon the track, the gate sprung and Stardust rushed forward, buck-jumping the first six strides and then settling into a long, distance-devouring run. Tony, well into character now, laid on his quirt and yelled encouragingly into the horse's ear. Gadget gestured at the control box and Angus took over. O'Dowd jumped up on top of the Cadillac, so he could see better.

Stardust went around the turn, came into the back stretch and began to thunder home. She was splitting the air like a lightning bolt. Above the pound of hoofs Tony's shrill, "Git! Git! Git!" and "Hi! Hi! Hi!" resounded. Stardust came into the home stretch, speeded up and dashed across the finish line.

Gadget went down, took over the controls and brought the mount to a plunging halt. Stardust came trotting daintily back toward the parked trailer, tossing her head, jingling her bit and making snorty noises which indicated that she was out of wind.

"Boy, she sure can run," said Tony.

"We'll give her two more trials," said Gadget. "And then we'll go over to that old Western town later tonight and batter down a couple of doors. She's got to be all ready by Wednesday. He was about to turn a dial on the control box when he noticed three men standing at the rail, looking interestedly at the horse. He was about to ignore them when he recognized one of the men from his pictures. It was Cliff Neary, the comedian and racing dean, who squandered the millions he made acting on horses. Beside him was his trainer and an exercise boy.

"Just watching your horse run," said Cliff. "Didn't know that Stardust had any colts." Cliff put out his hand to Gadget. "I'm the owner of the Neary stables," he said. "This is my trainer, Hank."

"Gadget O'Dowd," said Gadget, shaking the extended skin.

"Oh yes," said Cliff. "The special effects man. I remember that we contracted with United for some of your work on my 'Road to Smolensk'."

"'Road to Smolensk'," said Gadget thoughtfully. "Oh yes, that was the Vodka that broke into flame every time Roy Ellis spat."

"Good job," said Neary.

"There was nothing much to that. The things that were difficult in that picture didn't show at all."

"I know. You fellows never get much credit for all the little odds and ends that it takes to make a show hang together. But what are you

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doing out here with a horse? I didn't know that was in your line."

"Well, she's kind of a funny horse," said Gadget.

"Mighty good lookin' 'one," said the trainer, staring at Stardust hungrily.

"By the way," said Cliff, "you wouldn't like to put her up against three or four of mine, would you?" He was trying not to look sly. "Nothing like a good horse race after a long hard day's work at the studio."

Angus gaped and was on the verge of laughing when Gadget silenced him with a glare. "Well now," said Gadget, trying not to appear eager but negligently pulling half a dozen thousand dollar bills out of his shirt pocket, "don't mind if I do."

"'Don't mind if I do' is right," said Cliff, "Hank, bring Thunder Mountain over here. Do you think you can boot him through as a winner, Pat?"

Pat, a jockey, gave Cliff a white-toothed grin. "I reckon I can, Mr. Neary."

Tony watched all this with eyes which got wider and wider. Then he began to laugh. "Listen pal," he said to the jockey, "this is pretty tough company you're riding in. The last three jocks that tried to beat me got buried, with horseshoes of roses. I don't beat easy, see?"

The jockey grinned and helped Hank bring Thunder Mountain up to the rail. The horse was a big, powerful stallion that Cliff had bought for quite a piece of change. He was being kept under blankets until the Neary Stables could make a clean-up with him. Thunder Mountain, Cliff fondly believed, could make Man-of-War look like he was tied to a post.

Stardust breathed easily now and cavorted a trifle, edging near Thunder Mountain. That worthy, having horse sense, took one look at the bogus filly and whistled shrilly, backing off.

"Whoa now, boy," said Cliff. "I never saw you lady-shy before."

Thunder Mountain reared, shook his head angrily, and whistled again, backing even further away from Stardust. Gadget took his cue and removed his automagic horse down to the gate.

Presently they had both mounts behind the wire. And the race was ready to be run. The trainer held up a blank cartridge pistol, Angus got ready to release the gates, and Cliff eagerly yelled some final riding instructions to Pat. Gadget tried not to appear too interested in the control box on which he was sitting.

The gun roared. The gates sprang up. And horse and pseudo-horse were off in a cloud of sawdust. Gadget had to trust to it that the last running speed would at least keep in distance of Thunder Mountain until they reached the home stretch. Then he hoped he could adjust matters. The six crisp thousand dollar bills

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were weighted down by a rock, in company with another half dozen just like them which were fresh from Cliff's purse.

Angus, up higher, could see better. He began to make wild signals toward Gadget who turned up the running speed a notch.

The horse and pseudo-horse came into the back stretch with Thunder Mountain a full furlong in the lead.

The shrill "Ki-yi," of Tony rose above the wheezes and grunts of the running mounts and the pounding of their hoofs. Angus was making despairing motions with his hands, and glancing sideways now and then at Gadget.

O'Dowd was not idle. He pulled up the dial and very perceptibly Stardust began to close. When they were still seventy-five yards from the finish a wide gap yet remained. Gadget upped his dial another notch. Stardust's stride lengthened. Thunder Mountain, straining and lathered, felt the pseudo-horse surge alongside. He put on another burst of speed. But he was no match for Gadget's fingers on the dial. Stardust came neck and neck with Thunder Mountain.

In a close finish there was still no argument. Stardust had won!

Cliff turned disconsolately to Hank. "I thought you said that Thunder Mountain could run," he said. "Oh well, easy come, easy go. Mr. O'Dowd," he added with a bow, "the money is yours, suh. And it is a pleasure to lose to such a gallant gentleman."

Gadget stood looking at the fluttering green leaves. His conscience was hurting him.

"Mr. Neary," he said, "perhaps I ought to tell you that that horse of mine—"

"No, no," said Cliff, "a race is a race." He was looking at the mounts as they came up. They were blowing and whistling from their run. "Say now, that's mighty peculiar. That Stardust of yours doesn't even seem to be winded."

Gadget's heel came down on the control box. And Stardust really began to blow.

"No, he really isn't, I mean *she* really isn't," said Gadget. "In fact, I dare say, she could probably run another race if she had to."

Cliff looked up alertly. He glanced at the twelve bills and then at O'Dowd. "You don't mean to tell me that you'd be willing to risk another slight run for the money?"

"Well now," said Gadget reluctantly, "I think I probably owe it to you, Mr. Neary. Just the same—"

"Well, say no more," said Cliff. "Hank, bring up Sassy Lassie and we'll spin her around again. That is, of course, Mr. O'Dowd, if you have no objections?" If a man wanted to run a blown horse, who was Cliff Neary to refuse the money.

Gadget didn't, and the horses were soon lined into position. Sassy

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Lassie turned out to be a high-strung filly that the perspiring Pat found hard to manage. She tried to climb the rail, then the starting gate and finally consented to stay in position. Twenty-four thousand dollars, twelve of it in the form of a check on Cliff's bank, were now secured by the rock.

"We can't wait forever," said Cliff, afraid Stardust would get rested, "let 'em go."

The pistol banged, the gate lifted, and horse and reasonable-facsimile-thereof rocketed out into the track. Angus was standing high up, madly chanking Brown's Mule, and wondering about the strength of the various pins and cogs. He was wishing that he had foreseen this turn of affairs when he was at his forge.

Gadget, having surreptitiously tuned Stardust's eyes to a set distance off the rail, looked up to Angus anxiously for a signal. Gadget's conscience was hurting him. He liked Cliff because Cliff was a swell guy. "But when he finds out what the cause is he'll laugh about it," Gadget apologized to himself. Many times before he had vowed that he would pay the studio and his victims back once the fact had been accomplished and man had made a voyage to the Moon. His conscience thus assuaged, he was willing to forget it and enjoy the horse race.

Angus was making wild motions and Gadget upped the speed notch, only to find out that Angus' arm signals became wilder. Accordingly, Gadget slowly backed it down again. An action which resulted in the Scot's relaxation.

The filly and Stardust came scrambling into the stretch, pounding forward, straining every muscle and kingpin. Stardust was about eight lengths in the lead. Gadget understood his mechanic's earlier concern. Evidently the pseudo-horse had been traveling like a jet-job around the first turn. Gadget backed off the control dial even further and let Sassy Lassie catch up. They finished in a cloud of dust and hurrahs, out of which the fact dissolved that Sassy Lassie had been whipped by half a length.

After a little, Pat and Tony came back. The jockey was blowing and round-eyed.

"Mr. Neary," said Pat, "that there Stardust run away from me at the start like an airplane. I didn't think I'd never catch up."

"It's all right, Pat," said Cliff. "Somedays you can't ever see the back of your neck. Mr. O'Dowd, that's some horse you've got there. I wish there was a little more light, I'd like to look at her teeth."

"Oh her teeth are just fine, fine," said Gadget.

"I'm serious," said Cliff. "Now probably you've got a lot of things to do besides monkey with a hobby like race horses. Personally, it's not very lucrative. And if you are just starting out you ought to take the advice of the old master and give it up at the beginning, while you are still on the

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winning end. There, you're twenty-four thousand dollars richer—"

"Eighteen," said Gadget. "I've got no objection to horse racing, Mr. Neary. There are just some people who can make money out of it and some people can't. Didn't you say that you had another horse around here?"

"Well fan my brow," said Cliff. "Don't tell me that that filly of yours can run again?"

"It's like this," said Gadget, "I've raised her up from a . . . colt. She wouldn't be nothing but skin and bones if it weren't for me. And she knows it. She appreciates a good trainer when she has one. She'd be happy to run another race. Of course, I'll admit it's kind of dark—"

"See here, now," said Cliff, "if you think you can do it without wind breaking her, I've got Old Hundred over here. He's one of the fastest geldings I ever had in my stables. If you don't mind taking another check?"

There was a sliver of the moon showing in the west. Gadget cocked one eye at it and then looked at Cliff. "Mr. Neary, that check is good enough for me."

Old Hundred came up and went down. And when the dust had settled, Cliff stood with his hands in the pockets of his leather jacket, the brim of his hat pulled down, and his shoulders hunched with chill.

"I'm sorry, Mr. Neary," said Pat, climbing down from Old Hundred. "When we got into the stretch I just plain couldn't even see that filly's tail. She was that far ahead. Maybe I just ain't much of a rider, Mr. Neary."

"Oh, say not so," said Cliff, putting his arm around Pat's shoulders. "You're just up against a wonder horse, that's all." He snapped his fingers, whistled, and looked at Gadget. "That's three times I've been trimmed, Mr. O'Dowd. You wouldn't consider selling that horse, would you?"

With Angus and Tony looking on and gaping, O'Dowd gazed first at his toes, then at the moon, and then at Mr. Neary. Gadget knew his danger here. If he didn't go along with this sale Cliff, horse-hungry, would become more and more insistent, finally discovering the extremely mechanical identity of Stardust—a discovery which would lead to argument.

"Well, I might entertain an option," said Gadget, "on one condition."

"Well, now, a little old thing like a condition," said Cliff, "shouldn't stand between a couple of good horse traders."

"The condition is that she won't ever be used for breeding purposes."

"I think that could be arranged," said Cliff. He looked kind of sly and disinterested. "Would . . . er . . . fifty thousand dollars make the deal attractive? Say, ten thousand now as an option and forty thousand dollars tomorrow?"

"Oh, I can't deliver her right

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away," said Gadget. "She's on a special diet and I wouldn't dare take her off of it. You'd be surprised how that diet affects her. I have been making some scientific observations on her, too. And they won't be complete till Thursday morning."

Angus and Tony looked on in amazement. They had never got used to the glib and convincing way Gadget had with him when the necessity demanded it.

"Why Thursday morning," said Cliff.

"Well, I've got to observe the final effects of this diet. And then you can have her."

"You'll give me the diet, too?"

"You bet I will," said Gadget.

Cliff finished writing out his check and gave Gadget his hand. "It's a deal, my boy. My trainer will be up at your place Thursday morning to pick up the filly. Come along Hank, let's get out of this place while we still have enough money left to pay Uncle Sam his income tax. Good-by, Mr. Marconio and Mr. McBane. Come on Pat, you'll be riding winners yet."

Gadget stood looking after them as they left.

Angus grabbed his arm. "Och, laddie, how terrible it will be, the sight of you behind bars. Not only are you sellin' him somethin' that ain't a horse, but it's the property of United Pictures. Crime does not pay, me boy."

"Not very well, anyway," said Gadget thinking of Miss Franklin. "But cheer up. We have till Thursday morning to think up the rest of the idea."

"You mean you don't know?" said Tony.

"No, not yet," said Gadget.

"What a noive," said Tony, "what a noive! Let's load up and get out of here before you have any more of these half-thought-up ideas."

"Remind me when we get home to put the entry in my book: 'Eighteen thousand dollars to be paid back with interest to Mr. Cliff Neary.' He was just too nice about it. I haven't got the heart to take the money without putting it in my book to be paid off. Even if we did win it fair and square. After all, he asked us to race, we didn't ask him," Gadget said.

"What about the option money?" Tony asked.

"Don't worry, we'll figure out something." Gadget seemed rather cheered now that he had decided to put Cliff's name in the book as one of those to be repaid when the trip was finally made. He fingered the checks and even whistled a little on the way home.

Stardust having successfully broken down six doors without having sustained any injury left the Western set north of San Fernando in a shocking state of disrepair and on Wednesday the shooting of the picture started on schedule.

At seven o'clock in the morning everybody bundled up and went on

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out to the location at Gray's Ranch. Amongst the usual horseplay between the cameramen and the assistant directors, Gadget looked over the scene of action.

A big flimsy barn had been built. The roof tree was sawed half through and when the building burned that roof would come down, but quick. Wires and pulleys would assist the cave-in of the roof and mounds of hay containing flares were piled all about. The property man was giving the hay a final sloshing with smudge solution. There had to be a lot of smoke.

The stunt man went over the place to make sure there was nothing to trip over. He was a devil-may-care young man to all appearances. But in common with all good stunt men, the largest part of his daredeviltry consisted in the minuteness with which he planned the staging of his scenes. He bore several scars and had a slight limp, all of which came from some director's miscalculation in regard to falling off cliffs or leaping through plate glass windows.

The stunt man spent a few moments with Gadget going over the details of the shot.

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Veronica Morris and Peter Butler were there eating a belated breakfast in the shade of Butler's dressing room trailer. Marty Fitzgibbons was regaling them with an English music-hall anecdote.

"Hello, Gadget," Mr. Butler called out. "That's Gadget O'Dowd over there," he told Miss Morris.

"Where? Oh, hello, Mr. O'Dowd. I hope you fixed it so that poor stunt man won't get hurt. I'd feel pretty dreadful if anything happened to him for my sake."

"He'll make it all right," said Gadget, accepting the leg of chicken that Mr. Butler's valet handed him.

"Let's see it," said Mr. Butler, interested and getting up.

"Now, now folks," said the director. "There's no hurry about this. Morning Miss Morris. I'll have a cup of that coffee if you don't mind. Well, I see that you got the horse here all right, Gadget."

"I want to see that thing in action," said Mr. Butler. "I almost died laughing over that mechanical monkey Gadget built for the last Tarzan picture."

"Oh, I remember that," said Miss Morris. "He was certainly a wonderful 'animal'. Where is it now, Mr. O'Dowd? I don't suppose you could be persuaded to part with it?"

"The last I saw of it," said Gadget, "it was jumping up and down on Jacky Bocker's front lawn. When the accountancy department gets through with me I suppose it will be lying on the scrap metal heap in some local junk yard."

A cameraman came up with an assistant director. "We got three cameras on it, sir."

"Well make sure you get it the first time," said the director. "That barn will only burn once."

Gadget put down the chicken bone. "I suppose that's my cue," he said.

"I've got to see this," said Mr. Butler. He picked up his "bad man's hat" and followed O'Dowd over toward the horse trailer. Angus was ready with the control box. And Tony let down the back gate. Stardust stopped being immobile and began to champ and whinny. She backed down the ramp, turned, picked up her ears and, at Gadget's tip-off wink to Angus, Stardust came nuzzling up to Veronica Morris for a piece of sugar.

"Why, it's a real horse," said Veronica.

"Not if you put your ear to it," said Gadget.

"Why that's Stardust," said Mr. Butler, "that won the sweepstakes."

The director took one look and turned to the script girl. They put their heads together for a moment and the director came up. "It won't do," he said. "Two scenes further along, that we've already shot, have a sorrel without any forehead blaze."

"Sorry," said Gadget. "They didn't give me a script. Angus, hand that box of paint down here."

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In a very short space of time, water color had remedied the situation handsomely. And the script girl was satisfied. The property man came over and saddled Stardust with the proper riding equipment. The stunt man gave his mount wide-eyed admiration.

"Mind if I try a couple of tests on it?" he said. He mounted up. Gadget made the horse prance, cavort and strike with its front feet. Finally he put Stardust into a dashing run.

"Well, for once," said the cameraman, "we won't have to speed the film up on that one. That hunk of junk can really get out of here."

The director gave the order for "Places!" The sound man took his tests. The front doors to the barn were securely barred on the stunt man. Gadget took up his station just off scene, where he could look through a window into the barn, see the front door and the road which went off along the side of the corral. He had his control box all adjusted and tuned.

"Camera!" said the director. "Action!" An expert archer sent a blazing arrow across the scene into an explosives-loaded hay pile at the front of the barn. A second firebrand followed it, sticking in the side wall. A third thunked solidly into the shingles and in a moment the dry explosive-impregnated material flared and yellow fire curled greedily across the structure. More hay piles caught. A second stunt man ran forward. He was dressed in Huguenot garb. He pitched a torch in through the barn window.

The flames were beginning to crackle and roar. Gadget waited until the entire front of the building was blazing. Then, with an urgent wave from the assistant director, he set Stardust in motion. The roof was already beginning to sway. The temperature in the barn must have been mounted to about a hundred and thirty degrees. Stardust began to plunge and rear.

Then it dashed forward, flung up its hoofs, and brought them down solidly against the doors.

Outside, on signals, two Huguenot soldiers came up to lower arquebuses at the entrance. The doors caved. The assistant director's men gave a yank and the roof started down.

Out came Stardust! Narrowly missed by two blazing beams, nearly swallowed in clouds of white smoke and billows of yellow fire! The stunt man dressed in ladies riding garb was leaning on the neck and holding on in earnest. Stardust plunged, affected to rear at the two extras who now blazed away with their two arquebuses and fled off down the road at a fast run! Arrows and crossbow bolts thunked in her wake. She vanished far up the lane. The director called "Break!"

Next followed three shots, done on another set, of the now somewhat singed Stardust plunging and

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rearing in a mock interior. She had to break down a burning door in here, too. At eleven o'clock the work was finished. And, mounted on a real horse, Veronica Morris was ready to follow through with the close-ups. Mr. Butler was due to "perish" tomorrow. So today he could look on.

Gadget having lunched with the director and chief cameraman, receiving plaudits all around for his remarkable horse, was now free to return to his laboratory and do what he considered more important work.

As Gadget and Tony were backing Stardust up to the horse trailer they had one slight encounter with the S.P.C.A. representative who wanted to exam the "injuries sustained by the horse in that last scene." In the end, the man, who turned out to be quite a nice fellow after all, was their most appreciative audience. He just couldn't get over it. They let him examine a couple of the bolts down the throat, and unscrew a couple of teeth. "You are a genius, my boy," he said. "You are a genius. You should have proper recognition. Why there are museums all over the country—"

"Oh no," Gadget said hurriedly, "I could never do it again. It was just a fluke."

They finally escaped from the terrible prospect of the very unprofitable "proper recognition". "That was a narrow one," said Gadget as the man walked away. "If we ever got 'recognition' we wouldn't make enough to fly to Canada, much less the Moon."

They loaded the scorched Stardust into the trailer and they wheeled on home.

Miss Franklin was waiting for them. She had, gripped in her hand, a green slip of paper which she had obviously been holding half of the morning in anticipation of their return. Gadget took one look at it and knew what it was: The twenty-five hundred and twenty dollar kickback from the racing museum, twenty-eight hundred dollars minus ten percent.

"Now don't tell me this is a personal debt," said Miss Franklin in a silky voice. "The boy told me that he was to give it only to Gadget O'Dowd."

"Then how did you get it?" said Gadget.

Tony looked mournfully at a torn up flower bed. "Boss, she can wrastle, too."

"That skin the racing museum gave your mechanic can go right back to them. It will cost me a whole lot less than twenty-eight hundred dollars to have it restuffed. It looks to me, Mr. O'Dowd, like you didn't need any such budget. This makes you exactly two thousand and five hundred and twenty dollars under your estimate."

Gadget looked at her and sighed deeply. He went into his own office and slammed the door.

The following morning bright and

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early Cliff's trainer, Hank, drove up with a horse trailer which made the rental job look like something off a salvage pile. His men opened the door of this glittering creation invitingly. Hank went into the office to find Mr. O'Dowd. Fortunately Miss Franklin considered her office hours to be from nine to five. Movie people are ordinarily up long before that.

"Well, well," said Hank, "here I am."

"Well, well," said Gadget, "I see you are."

"Shall we load the horse aboard now?"

"Well, you see," said Gadget, "I've been thinking this thing over rather carefully and I've decided—"

"You're not going to back out on the deal now?" said Hank.

"Well," said Gadget, "I was thinking—"

"Mr. O'Dowd," said Hank, "you look to me like a man of your word. You wouldn't go back on Mr. Neary, would you? He could do you a lot of good."

"That isn't all he could do to him," said Angus under his breath.

Gadget was thinking fast. If he confessed this sin he would certainly have to refund Cliff's losses. But if he didn't, then he would have to give Cliff the horse. Due to his disturbed state of mind because of the twenty-five-hundred-and-twenty dollar hole in the budget he had not come up with the brilliant idea of which he had thought himself capable.

"Where is the horse?" said Hank suspiciously. "She's all right, isn't she?"

Gadget was about to report the theft of Stardust when one of the men spotted her in the bar. "Funny place to keep a horse," said Hank. "I hope she doesn't drink! Well, shall we load up?"

"She looks kind of singed," said one of the men. "What happened?"

"Nothing serious," said Gadget. "Nothing serious at all."

"Funny look about that horse," said the other man.

"Well, she's just a little bit off her feed today. All that running didn't help her any. Tony, we are being very remiss in our hospitality. Take these gentlemen inside and give them something to eat or drink."

"I got a fresh cup a coffee if you want some," Tony said.

"You go ahead too, Hank. I'll put her in the trailer," Gadget said.

Tony hustled them inside, and Gadget loaded Stardust on board the super-deluxe horse trailer. When they came out again Hank saw Stardust's ears above the trailer side, handed Gadget the check from Mr. Neary and they agreed to sign all the necessary papers on Saturday morning. Hands were shaken all around and soon the yard was deserted.

Ten seconds later Miss Franklin drove on the scene.

"What was that horse trailer?" she demanded.

The smile which Gadget had worn

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at the departure now vanished. "Well, you see, that Stardust—"

"You mean you've let somebody else have a piece of property belonging to United Pictures? You must realize that there is a lot of valuable equipment in there that can be salvaged," said Miss Franklin primly. "You've already exceeded your—"

"D'ye mean to say that we've got to go to all the toil of taking that horse apart?" said Angus coming belatedly to work.

"I mean just that," said Miss Franklin. "We'll restore that hide to the museum and put all the various parts on the inventory." She went into her office and could be heard arranging things for her day.

Gadget looked at Angus. "Bring the control box out," he said.

Angus was in no mood to be lightly ordered about, but he went. "Dismantlin' a horse!" he was snorting. "Filing parts! Inventory! What the picture business isna comin' to would— What in the saintly name has happened to this control box." He came back out, his basic anger building. "Musther O'Dowd! Some scut has unsoldered—!"

"Give it here," said Gadget hastily. "I was in a hurry. I didn't know when they'd look at me. Give me that box!"

Miss Franklin, curious as to what was going on out in the court, issued from her office, aggressive as an overdue bill. "What are you doing?" she demanded. "When the front office learns—"

Suddenly a roaring whine resounded in the sky. Looking up, a terrified Miss Franklin beheld a horse! It had been rising ever since the trailer had begun to move, having issued straight up, and now it had a very, very long way to come down.

Miss Franklin screamed! Stardust was falling faster now, falling with the gathering speed of a blockbuster, falling so fast that the air was split and scorched.

Down came Stardust from its suspended station. Down came Stardust getting big and bigger, louder and louder. Down came Stardust with a crash!

Dust shot away! Hoofs and hide contracted, seemed buried in the earth and then bounced with a geyser of wheels, cogs, tubes, rheostats and useless condensers. Up went the electronic shower, down came distended rods and shattered bric-a-brac, mingled with spattering, twisted pieces of torn hide.

Stillness came. A radar eye rolled pathetically to Gadget's feet and lay there, teetering, looking at him accusatively. The dust settled, slowly, quietly and much of it upon a cowering Miss Franklin whose disarrayed nerves were almost as damaged as the late and unlamented automagic horse.

"Gravity repulsor," said Gadget O'Dowd. "Installed it at the last minute in a streak of proud genius. Works fine, doesn't it, Angus?" He looked benignly at Miss Franklin.

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"Gravity repulsor, installed to conduct a scientific experiment in the interests of the future safety of stunt men. Solder seems to have broken so that I couldn't slow it down."

"What . . . what happened?" said Miss Franklin.

"Why," said Gadget, "in the interest of picture research, we installed a gravity repulsor which lifted Stardust out of the trailer and deposited her back here where she belongs. And I think you will find that this experiment cost exactly twenty-five hundred and twenty dollars to conduct, including the cost of the gravity repulsor unit, of course." He looked brightly at the scattered remains which were strewn widely across the flower beds.

Miss Franklin gulped, looked at Gadget with baffled but dawning respect and then took her tired way into her office.

"Loddie," said Angus, "'tis a great project on which we're embarked. But I'm thinkin' if ye keep this up ye'll find it *necessary* to go to the Moon—aye and a divil of a lot farther before we're done."

"Boss," said the worshipful Tony, "that sure was a bang-up solution to dat problem!"

Gadget reached into his jacket pocket and brought out the purchase checks which Mr. Neary had given him for the sale of Stardust. He handed them to Tony. "This hurts me more than I can say, but one must be honest after all. Take them over to Mr. Neary and tell him how sorry we are that his new horse ran away. Tell him it was a bad habit she had anyway."

"Give him back fifty G's?" gaped Tony.

"My boy," said Gadget, "you have evidently forgotten how much money we made off him on the bets. My conscience," he added, with a bright, self-denying smile, "wouldn't permit me to keep his checks for a horse he never owned."

"Your conscience," said Tony, with disgust, "is the most expensive thing we got!" He pulled on his gloves, took the money and drove away.

In the dark of night another mile of tunnel to a "gamma room" was started into the Hollywood Hills. And enough metal for a spaceship's bow was smuggled, the very next day, straight under the vigilant nose of Miss Franklin.

Gadget and Angus and Tony were that much closer to the Moon. "I hope humanity appreciates the trouble we've gone to for it," said Gadget. But there was so much noise around the busy forge that Angus and Tony didn't even hear him.

THE END

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CHANCE REMARKS

BY J. J. COUPLING

***Remember** "Fifty Million Monkeys"? There was a basic idea in that, and this pure fact article recounts an actual analysis of the problem of a "semantic selector"—and how it might work! A truly fascinating bit of communication research it is, too!*

There has been a lot in the papers about Cybernetics and the theory of communications recently, but as usual, Astounding SCIENCE FICTION was ahead of all others—back at least as far as 1943 and Raymond F. Jones' story "Fifty Million Monkeys." You may remember the "semantic analyzer" which selected meaningful words from random letters. Now something very like that has appeared in the most respectable sort of print.

It was a long and indirect route if any which led from Jones' story to an authoritative publication, "A Mathematical Theory of Communication," by Dr. C. E. Shannon. Dr. Shannon, who is now at the Bell Telephone Laboratories, is a product of the Massachusetts Institute of Technology and of the Institute for Advanced Study at Princeton. His accomplishments include the application of Boolean Algebra—a symbolic logic—to the problem of telephone switching. His new work, which won him the Morris Liebman Memorial Prize of the Institute of Radio Engineers, is a fine exercise in multidimensional geometry and probability theory.

The whole field that Dr. Shannon covers is important, but it is so broad as to make a simple explanation exceedingly difficult. Too, much of the material, while of great technical importance, may seem to have little interest for any one but an expert. But part I section 2 of the paper, "The Discrete Source of Information," deals with something which seems right up the science-fiction alley. That is, the statistical structure of written English.

The American Telephone and Telegraph Company has been interested in transmitting English in one form or another for many years. I suppose it was inevitable that sooner or later someone should examine the material which they handle. But, when one first reads Dr. Shannon's words it seems that a language, and written English to be specific, means something quite different to him from what it does in common usage. This is natural. One believes that a communications company cannot afford much interest in the sense of the

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material which it transmits. A correct reproduction is required. Whether or not the words sent are worth sending, or even, whether they make sense, cannot be of immediate concern. Because of this, one might wonder whether there can be any general interest in even this part of "A Mathematical Theory of Communication." Such an interest may, I think, develop in the telling.

First, however, one must know why the telephone company is interested in English, and what it is to them. Although this involves very long-range considerations, it can be made clear by a simple example. If you have ever watched a man trying to write a Christmas telegram, you may feel that he profited in the end by the telegraph company's neat arrangement. A few numbered messages express tritely about all that most people can say on the occasion. The cost is that of sending a short number instead of many words. The operator at the far end looks the message up by number in a little catalog, transcribes it, and the original message thus reaches the addressee without having been sent word by word at all.

It might seem absurd to apply such a principle to English text in general, but, in theory at least, this is merely more difficult. There is only a finite number of messages, that is, of combinations of symbols, which could be typed on a sheet of paper. Thus, we might merely type out all such messages, number them, and send the numbers instead of the messages. It turns out that this would result in no saving, because there are so many of such "messages". Even if we used double-line spacing and restricted ourselves to capital letters, spaces, commas and periods, the number would be about one followed by twenty-five hundred zeros.

Obviously, the suggested numbering of all of these messages is impossible. What is worse from a mathematical point of view is that it would be grossly inefficient. Many among the possible combinations of symbols would never be sent, at least, not in this country. More are in German and Italian and Swedish and French and in other languages than are in English. Some disclose the government's most closely guarded secrets—but which? Some are subversive. Many others would be censored. But, most of them are completely unpronounceable. They are combinations of symbols which make no sense at all.

It is, in fact, immediately clear that English text is in some way set aside from mere combinations of letters. It is set aside in a way which is important to one who is trying to transmit information. Subjectively, one easily tells whether text is English or whether it is not. There is, however, an objective distinction.

Dr. Shannon describes this by saying that written English is *redundant*. That is, more symbols are used than are needed to convey the information. Now, what is im-

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portant is that the excess symbols are introduced according to certain rules, which a mathematician calls statistical laws or probabilities. For instance, *q* is always followed by *u*. Most of the rules are not this simple. However, a writer in mid-word or in mid-sentence does not—ordinarily—exercise complete freedom of choice in setting down the next letter or word. The choice of some letters or words is completely ruled out, or, such choices have zero probability. Among the letters or words allowed, some are more probable than others. For instance, because of our unconscious knowledge of such statistical rules, or of certain specific instances of them, we can correctly reconstruct most text—the reader can easily verify this—even if many of the individual letters have been erased or struck out. When we cannot, as in the case of some passages from Gertrude Stein or James Joyce, it is because there is something objectively un-English about the original text. That is, the text doesn't follow the rules. Granted conventional English text as a source from which to draw statistical rules, it is theoretically possible to tell English text from un-English sequences of symbols by applying statistical tests.

Dr. Shannon's work has led him to believe that English is about fifty percent redundant, that is, that one has about half as much freedom of choice as if symbols could be chosen with complete freedom. This is no trivial observation, for it has all sorts of implications. For instance, this degree of redundancy makes it just possible to construct crossword puzzles. If there were no redundancy, any arbitrary combination of letters would be a word. Thus, any set of letters could be read up or down as well as crosswise, and backward, too. There would be no puzzle to crosswords. If the redundancy were much greater than fifty percent, there would be so little freedom of choice in the sequence of letters that it would be impossible to achieve a crossword pattern. The degree of redundancy of English allows the construction of crossword patterns with some difficulty, and makes the language almost ideal for crossword puzzles. Conceivably, crossword puzzles could not succeed in some countries because the structure of the language would make them virtually impossible.

It is this same redundancy which potentially allows a saving in transmitting English text. It is cheap to telegraph a Christmas greeting because the message sent is chosen from among a few possibilities. Because there are rules relating the combinations of symbols, these restrict the number of English messages of a given length. The selection and numbering of page-long English messages suggests itself because these form a—comparatively—small set among possible combinations of letters, spaces, periods and commas, and the nonredundant num-

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bers describing this small set would suffice for all sane Americans. But how many un-English messages are there to be discarded, and what can one do about it? This, essentially, is the language problem as it appears to a mathematician.

To the mathematician a language is a "stochastic—i.e., a statistical—process which generates a discrete sequence of symbols from a finite set." These symbols are the letters of the language, together with punctuation and spaces, if these occur. The stochastic process chooses these symbols in accordance with certain probabilities which involve the sequence of symbols already chosen. Thus, if part of a word or a sentence has been written down, the probability, as evaluated from ordinary English text, that the next letter will be *a* may be very high, while the probability that the next letter will be *e* may be very low, and these probabilities will depend on the preceding letters and the order in which they occur—that is, on what has already been written down.

If the statistics of the language were completely known, it would be possible—again in theory—to evaluate exactly the saving which could be made in transmitting English text. It would also be possible to do other things of which we shall have a hint later. Of course, a knowledge of the whole statistical structure of a language is an unattainable ideal, but one need not for this reason forgo all knowledge. Indeed, Dr. Shannon has done a little preliminary exploration himself in a surprisingly simple and a rather interesting manner.

We already know from work on cryptography, and can obtain from other sources, a small part of the statistical laws of English text. Now, suppose we choose symbols—letters—by a chance process incorporating the rules which we know and see how nearly the result resembles English. This will give us some clue as to the relative importance of the part of the statistical rules which we know and employ, and the unknown part of the statistics of the language.

Dr. Shannon gives first an exceedingly simple example:

"XFMOL RXKHRJFFJUM ZLPWCFWKCYJ FFJEYVKCQ-SGXYD QPAAMKBZAACIBZL-HJQD"

Here the letters and spaces are succesively drawn at random with equal probabilities for all symbols. Here, for instance, *x* and *z* are as common as *e* and *a*, which they certainly are not in English text. The combinations are un-English, unpronounceable and uninteresting. Mathematically, we say that the statistics are incorrect.

"OCRO HLI NMIELWIS EU LL NBNESBYA TH EEI ALH-ENTTPA OOBTTVA NAH BRL"

Here letters were chosen, still independently, but with regard for their probabilities in English. If they were chosen from a hat, there would be more *e*'s in the hat than *z*'s, for instance. There is still, how-

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ever, no rule connecting pairs of letters; there is no rule saying that *u* is the only letter which has any probability at all of following *q*. Still, some of the statistics of English have been taken into account, and the result is surprisingly more like English than the first sample. The letters do occasionally form word-like combinations. Although it is not in the dictionary, OCRO is pronounceable. It is interesting to think of OCRO as a nonsense word, and to wonder who invented it. It was really begotten, although through a human agency, by an undistinguished copy of a book of random numbers. A machine following the rules could as easily have arrived at the combination.

"ON IE ANTSOUTINYS ARE T INCTORE ST, BE S DEAMY ACHIN D ILONASIVE TUCOOWE AT TEASONARE FUSO TIZIN ANDY TOBE SEAGE CTISBE"

This has some intriguing features. Here more of the statistics of English were observed, and each letter or space was chosen in accordance with its probability of following that preceding. If *q* had occurred in the example, it could have been followed only by *u*. This has resulted in combinations of symbols which strongly resemble English. ARE is a real word. INCTORE and ILONASIVE are not words, but they are very wordlike. DEAMY almost suggests meaning, and is perhaps worthy of remembrance. One begins to wonder if Dr. Shannon's work has some literary significance. Can senseless statistics perhaps aid to our vocabulary?

"IN NO IST LAT WHEY CRATICT FROURE BIRS GROCID PONDENOME OF DEMONSTURES OF THE REPTAGIN IS REGOACTIONA OF CRE"

To an unprejudiced reader, this is not only largely pronounceable, but it sounds like talk, and English talk more than anything else—it contains seven Engilsh words. Or, if you wish, the passage sounds like double talk. It is perhaps difficult to believe that in constructing this passage no conscious effort was made to make up English-like combinations. The procedure of construction was, however, purely automatic; each letter was chosen in accordance with the probability of its following the ordered pair of letters preceding it.

It must be understood that, because of the increasingly elaborate statistics involved, these passages were increasingly difficult to construct. A complicated machine could do more, but without one it seemed impractical to go further, and to base a letter on a preceding ordered triplet of letters. We can, however, see where the process would lead. If we added letters according to rules involving three, four, five and more preceding letters, we would gradually rule out as of zero probability all combinations which do not appear as words in the dictionary. We might as well,

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indeed, use words as our basis of choice, and Dr. Shannon has tried this, too. As a first example he chose words merely on the basis of their probability of appearing in English text:

"REPRESENTING AND SPEEDILY IS AN GOOD APT OR COME CAN DIFFERENT NATURAL HERE HE THE A IN CAME THE TO OF TO EXPERT GRAY COME CAN DIFFERENT NATURAL TO FURNISHES THE LINE MESSAGE HAD BE THESE"

This seems rather a retrogression. The statistics are unduly simple, for they provide no connection between words. With a great deal of effort, Dr. Shannon was able to provide such a connection, however. In obtaining the following passage, a pair of words was chosen at random in a novel. The novel was then read through until the second of these words was encountered again, and the word following it was inserted. Then that new word was sought out in a new context, and the word following it there was added, and so on. This laborious process evoked:

"THE HEAD AND IN FRONTAL ATTACK ON AN ENGLISH WRITER THAT THE CHARACTER OF THIS POINT IS THEREFORE ANOTHER METHOD FOR THE LETTERS THAT THE TIME OF WHO EVER TOLD THE PROBLEM FOR AN UNEXPECTED"

Here we have merely an example of words chosen randomly according to certain statistics. We may, however, have a strange feeling that we have seen something like this before. Certain passages in "Ulysses" and "Finnegan's Wake" are scarcely more intelligible. Despite an apparent lack of connection, the passage has some subjective interest. I have a sympathetic concern for the predicament of the English writer. I would like to ask the author more about him. Unfortunately, there is no author to ask. I shall hear no more unless, perhaps, chance should answer my questions. One wonders if Dr. Shannon's work has philosophical implications.

Dr. Shannon stops at this point. The idea of pursuing the matter further is, however, tempting. By taking into account more and more statistics in the choice of letters, all letter combinations but English words could be ruled out. Can we, by the use of a more elaborate statistical choice of words, rule out all word combinations which don't make sense? At least, we could construct something better organized than the last example.

Suppose, for instance, that a word were chosen in accordance with its probability of following the preceding three words. Although this might seem unduly difficult, a trick will overcome all obstacles. English and its statistics reside in the human brain and they can be tapped at the source. One has only to show a list of the latest three words of a passage to a person unfamiliar with

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those preceding and ask him to make up a sentence including these three words and to write down the word which, in that sentence, follows the three. The statistics linking four-word combinations are automatically evoked in this process. The word chosen *can* and *is likely to* follow the three. There is, however, a chance element in the choice. The word chosen is not *determined* by the preceding three words, for different people, or the same person at different times, would choose a different word.

In following this procedure we can also, without added difficulty, include punctuation and capitalization. This further lends naturalness to the result.

Starting with the words, "When the morning—" I obtained from twenty-one acquaintances:

"When the morning broke after an orgy of abandon he said her head shook quickly vertically aligned in a sequence of words follows what"

This begins well, and the eighteen words following the initial three have a clear meaning. Afterwards there is a wandering of the mind, as in some cases of schizophrenia*. But whose is the meaning, and whose mind wanders? We must admit that the meaning exists only in the minds of the readers. Each of the twenty-one writers knew only four words, and each thought of them in a different context. There was no "meaning" until someone read the completed passage. And there was no wandering of the mind, but only failure of such short-range statistics as were taken into account to hold the text together over many words. The words are connected to those immediately preceding them, but have no connection with those further ahead. I think, however, that it is the seeming sense of the passage and not its long-range incoherence that is astounding. And, it is a little disturbing to think that an elaborate machine, taking longer-range statistics into account, would have done still better. The passage seems to us to have meaning, and yet the true and only source of this quotation is a small part of the statistics of the English language—and chance.

Presumably, written English is coherent over long stretches, when it is, because of some overriding purpose in the writer's mind. Or, is it coherent because the writer is unconsciously constructing his text to obey certain long-range statistical rules? And, we wonder, how many times does a person let his pen or tongue, started by some initial impetus, merely run through a sequence of probable words?

This sort of investigation became interesting for its own sake. A couple of hours spent in a conference room with two mathematicians and two engineers produced a half a dozen curious forty-word bits. It is scarcely worthwhile to quote the whole of these, but some selected sentences may be of interest.

*I quote from Menninger's "The Human Mind," third edition, page 233, "Have just been to supper. Did not knowing what the woodchuck sent me here. How when the blue blue blue on the said anyone can do it—?

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"When cooked asparagus has a delicious flavor suggesting apples."

"No man should judge his actions by his wife Susie."

"It happened one frosty look of trees waving gracefully against the wall."

We see that the statistics involved are sufficient to give "meaning" frequently, but are scarcely adequate to insure "truth". But, if we mean by truth merely that which we are likely to find written in encyclopedias, statistics could presumably supply it, too. With the statistics which we have included, however, any merit of such compositions is more apt to be aesthetic than factual. The last sentence has, for instance, a rather pleasing twisting effect which might have escaped a conscious artist.

We are reminded that philosophers have argued for years about how much of art lies in the work of the artist and how much lies in the observer. I do not know whether or not Dr. Shannon had anything of this in mind, but these consequences of his work certainly have an interesting bearing on the matter. Here there is no creator or "artist." The structure of the words is based merely on statistics, or, on the likelihood of their occurring in a certain order. Yet, they may have "meaning" for the reader, and he may have an aesthetic appreciation of them.

The passages quoted above were rather disconnected. Our interest finally led us to try a drastic and unscientific experiment. If lack of long-range connection were the chief trouble with the text, we could remedy that. On the bottoms of the slips of paper on which we wrote the words, in plain sight of all, various subjects were indicated, among them *salaries, murder story* and *women.*

The statement on salaries is of interest for a certain partisanship:

"Money isn't everything. However, we need considerably more incentive to produce efficiently. On the other hand too little and too late to suggest a raise without reason for remuneration obviously less than they need although they really are extremely meager."

The *murder story* slip contained a passage which goes a little beyond the bloodiest and most disconnected of the genre:

"When I killed her I stabbed Paul between his powerful jaws clamped tightly together. Screaming loudly despite fatal consequences in the struggle for life began ebbing as he coughed hollowly spitting blood from his ears."

It was on the final slip, *women,* that chance really spoke through clearly. The forty-two word statement is succinct but not entirely quotable. The last sentence says a great deal:

"Some men repeat past mistakes again and again and again."

Perhaps this adage appeared because it has so likely a connection with any part of our lives, our scientific interests included.

THE END

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THE GREAT FLOODS

BY L. SPRAGUE DE CAMP

The tales of great floods occur in all mythologies—Biblical floods, Atlantean floods, all over the world there are legends of the Great Flood. But you know, THE great flood always was, and always will be, the flood that flooded YOUR land....

Genesis says: "In the six hundredth year of Noah's life . . . were all the fountains of the great deep broken up, and the windows of heaven were opened. And the rain was upon the earth forty days and forty nights.... And the waters prevailed, and were increased greatly upon the earth.... Fifteen cubits upwards did the waters prevail; and the mountains were covered.... And every living substance was destroyed which was upon the face of the ground . . . and Noah only remained alive, and they that were with him in the ark. And the waters prevailed upon the earth an hundred and fifty days."

The Greeks also had a tradition that "when Zeus would destroy the men of the Bronze Age, Deukalion by the advice of Prometheus constructed a chest, and having stored it with provisions he embarked upon it with Pyrrha. But Zeus pouring a heavy rain from heaven flooded the greater part of Greece, so that all men were destroyed, except a few who fled to the high mountains in the neighborhood.... But Deukalion, floating in the chest over the sea for nine days and as many nights, drifted to Parnassos, and there, when the rain ceased, he landed and sacrificed to Zeus, the god of Escape."

Finally, Plato in his dialogues told of his ancestor Solon's tour of Egypt. In the course of this visit a priest told Solon of a continent in the Atlantic Ocean whose people had once warred with a prehistoric Athenian empire until the gods got tired of the performance, whereupon "there occurred portentious earthquakes and floods, and one grievous day and night befell them, when the whole body of your warriors was swallowed up in the earth, and the island of Atlantis in like manner was swallowed up by the sea and vanished; wherefore also the ocean at that spot has now become impassable and unsearchable, being

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blocked up by the shoal mud which the island created as it settled down."

Many other peoples have flood legends as well. Now, where do these ideas come from? People don't make myths up out of nothing at all, though on the other hand they exaggerate the real events the myths are based upon and mix them up with other stories until it's quite impossible to filter out the truth in the resulting fiction. Flood legends indicate little more than that there have been devastating floods in times past. There have also been lulus in historic times, for instance:

In 1876 the Ganges River, in high water, flooded the lowlands of Bengal, and a great storm which piled the water still higher around the mouth of the river submerged three thousand ninety-three square miles, killing two hundred fifteen thousand people.

In the Netherlands there used to be a great flat depression slightly below sea level with a lake, the Flevo Lacus, in the middle. In 1282 a terrific storm broke through the sand dunes separating this depression from the North Sea, and in a single day the sea overran the whole area, forming the Zuider Zee. The industrious Dutch have been pumping the water out again ever since.

In Indonesia there is a half-submerged volcano called Krakatoa. In 1883, after several days of grumbling and smoking, the mountain burst cracks open in its sides, allowing the sea water to rush in and mix with the red-hot lava inside. The water flashed into steam and Krakatoa blew up with an explosion that makes Hiroshima look like a firecracker. A man on an island at the other end of the Indian Ocean, three thousand miles away, heard the roar. The smoke and dust shot up thirty miles and took nearly a year to settle completely out of the atmosphere. The outburst kicked up a wave fifty to one hundred feet high, which drowned thirty-six thousand five hundred people living along the shores of the nearby islands, and which was detected eight thousand miles away.

Now how does it happen that such large areas of the earth can be covered with water from time to time? How much land can be flooded, and how rapidly, and for how long?

The four main causes of the drowning of lands are the flooding of river valleys, the invasion by the sea of an area below sea level, the tsunami or earthquake wave, and permanent sinking under water as a result of movements of the earth's crust.

River-valley floods like those of the Mississippi are probably the source of most of the flood legends, since civilizations commonly arise in river valleys where such floods happen. They happen because in the upper part of its course, where the slope is steep and the current swift, a river picks up silt from the bottom. Then in the lower part of its course, as it nears the sea, its slope is gen-

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tler and its current slower, so that it drops the silt it had previously picked up. Therefore its bottom in this part gets higher and higher. Eventually when a rainy spell comes along the river overflows its banks and sometimes makes a whole new channel in another part of the flood-plain. Men try to keep the river in one place by building up the banks with levees, with the result that the river gets higher and higher above the surrounding country, and the flood is that much more destructive when it does come.

However, such floods usually affect only a limited area, and their effect is only temporary. Still, such floods sometimes spread over such a huge area as to make their ignorant victims think that the whole world has been deluged.

Some historians have suggested that Noah's Flood, for instance, may be based upon a real flood that submerged something like forty thousand square miles of the Euphrates Valley about 5,400 B.C. In 1929 the archeologist Woolley, digging in the valley, found an eight-foot layer of clay with no human relics in it, below which relic-bearing layers of rubbish began again. This clay indicated a vast flood back in Sumerian times. The exact cause of the flood is still doubtful, since the Euphrates is nowadays a fairly well-behaved river; but a terrific flood there surely was.

Sumerian chronicles treat the flood as a historical event and mention kings and cities that existed before and after it. The flood probably wiped out the dwellers in the lowlands, but spared some cities on higher ground. Besides the historical records of this flood, there arose a whole family of legends based upon it. The Sumerian priests composed the tale of the pious Ziusudra who, warned of the flood by which the gods meant to liquidate mankind for its sins, escaped from the city of Shurippak with his family and livestock in a boat, which eventually grounded on Mount Ararat after the hero had sent out birds to scout for land.

When the Babylonians replaced the Sumerians they took over the legend, changing the hero's name to Utnapishtim. Later when Nebuchadrezzar II of Babylon carried off the Hebrews of Judea to captivity in Babylon, the Hebrews borrowed the story in their turn, transliterating Utnapishtim to Noah! Only in a place as flat as the Euphratean Plain could anyone imagine that a rise in the water level of "fifteen cubits"—less than twenty-five feet—could submerge all the mountains in the world. Finally, somebody brought the tale to Greece back in the early days of Greek civilization—before 500 B.C. In Greek mythology Ziusudra became Deukalion, though Ziusudra's name survived as that of Deukalion's mythical grandson Xouthos; mythological figures are always merging and dividing like amoebae.

In trying to reconstruct what ac-

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tually happened, we mustn't take these myths too seriously. The people who wrote them were not historians in the modern sense, trying to preserve records of actual events, but priest-magicians concocting magical spells for the control of supernatural beings, or devising stories to answer young people's questions about how things came to be the way they are, or spinning fables to teach the tribesmen to obey their chiefs, revere their priests, and obey the tribal laws.

Catastrophes do happen, and myth-makers use them in making up their catastrophe myths, just as detective stories are based upon the fact that real people are sometimes murdered under mysterious circumstances. Thus while a flood legend may be based upon a real flood, it is not so much a historical record of any special inundation as a fiction that has borrowed a plot-element from reality, as all fictions do. As to why early priesthoods cherished flood legends so, think how beautifully adapted such stories are to scare a congregation into putting up the money for a new roof to the temple when the old one has begun to leak!

Areas below sea level are sometimes inundated when the sea gets access to them. Some geologists think that back in the Pleistocene Period, when our ancestors were in the Old Stone Age of culture, the whole Mediterranean basin was a dry depression of this kind, with a couple of moderate-sized lakes separated by a land bridge from Italy to Africa. As the glaciers melted and the sea level rose, they say, the Atlantic finally broke through what was the Isthmus of Gibraltar and flooded the basin, forcing thousands of primitive men and millions of animals to flee.

Some have seen in this inundation the origin of Plato's Atlantis story. However, it's unlikely that illiterate primitives could hand down the account of such an event for any ten or twenty thousand years; moreover, if you compare the size of the faucet with that of the tub, you'll see that it must have taken many years to fill up the Mediterranean basin, so the flooding would have been a slow process.

Similar floods on a smaller scale have, however, occurred, as in the case of the Zuyder Zee. In several parts of the world—the Sahara Desert, around the Caspian and Dead Seas, and in Australia—a connection with sea level water would cause floods of this kind. In 1906, in fact, the Colorado River flooded part of Imperial Valley in Southern California below sea level, and would have flooded the rest but for the heroic efforts of the employees of the Southern Pacific Railway to force the runaway river back into its bed.

Ancient authors like Florus told how the Kelts and Germans of the northern coast of Europe had been driven from their homes by floods like these, and their accounts sound much like the later medieval-Keltic stories of Ys and Lyonesse. In

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Breton legend the city of Ys stood in early Christian times on the shores of the Bay of Trespasses. Its king, the rich and pious Gradlon, protected it from high tides by a wall and a basin to receive the overflow. Once Gradlon's dissolute daughter Dahut got drunk with her lover and, after various pranks, opened the sluice gate in the wall with the key which she had stolen from her father. St. Gwenole, the founder of the first monastery in Brittany, warned his patron the king, who leaped on a fast horse and galloped off just ahead of the surf.

Similar tales are told of Lyonesse, an island supposed to have stood off the tip of Cornwall, of Cardigan Bay in Wales, and of Lough Neagh in Ireland. The Irish of Connemara tell of a sunken city offshore that will one day come up again, at which time Galway will in its turn be submerged. One stormy night in 1946 these good folk were horrified to see a host of lights twinkling over the water where the city should be. Their fears were confirmed when a man who tried to telephone Galway was told by a fresh operator: "There's no reply; they must be all dead in there." At dawn, however, the Connemarans were relieved to see the "city", a fleet of Spanish trawlers riding out the storm in the lee of the Aran Islands, hoist anchor and sail away.

Some have thought that these traditions refer to a series of actual floodings of the coasts of Northern Europe like that of the Zuyder Zee. During the Pleistocene Ice Age England and Ireland were joined to Europe and the North Sea was a low plain. It sank beneath the sea between twenty-five thousand and ten thousand years ago, and today fishermen sometimes dredge up stone-age tools and mammoth teeth from the North Sea bottom.

The next source of flooding is the tsunami—rhymes with "balmy". "Tsunami" is a Japanese word that seismologists use for the earthquake wave or—as many people misleadingly call it—the "tidal wave". An earthquake under the sea sometimes sets up a series of these waves, the biggest first. While out at sea a tsunami cannot usually be seen by the naked eye because its slopes are so gentle, it becomes higher and steeper as it nears the shore. If it happens to meet a gently sloping offshore bottom, or a shallow bay opening toward the direction whence it came, it may rise scores of feet with horrid results. Usually the wave does not take the steep form of a breaker, however, but is more like a sharp sudden super-tide that rises far above normal levels.

In the last two and a half centuries there have been, counting Krakatoa—which was not strictly speaking an earthquake wave—eight tsunamis over fifty feet high. One, in Kamchatka in 1737, reached the awesome height of two hundred ten feet. The west coast of South America is particularly liable to these disasters; the Callao wave of 1746 sank nine-

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teen out of twenty-three ships anchored in its path and carried the rest far inland.

The heights of tsunamis are estimated from the levels at which damage is done or debris found, since most sensible folk, seeing a tsunami coming, would not stand gauping at it long enough to make a good estimate. Also, they reach their greatest heights only along short stretches of beach where the bottom formation is of the right kind.

However, even the most violent tsunami does not bring about any great change in the shape of the land, for after the water recedes the shoreline is left much as before. Classical writers told of tsunamis in the Mediterranean, and Plato, who would not have distinguished between temporary and permanent effects, or between a rise of water and a subsidence of land, might have got the idea of the foundering of a continent from some such account—perhaps from Thucydides's description of the inundation of the little island of Atalantë off the coast of Greece by a tsunami in 426 B.C., the year before Plato was born. Atalantë even sounds like Atlantis.

Plato also, you remember, said that in the Atlanto-Athenian war the Athenian army was swallowed up in the earth by the great quake. It used to be thought that in big earthquakes, cracks opened in the earth big enough to gulp down a whole city—a much exaggerated idea. Earthquakes do open cracks in the ground, but only the sort that a man might break a leg in if he were careless; nowhere nearly big enough to swallow a house, let alone a city or an army.

Now, either earthquakes or eruptions may change the shape of the land and lower it beneath the sea. The Krakatoa eruption destroyed an island one thousand four hundred feet high and left water one thousand feet deep where it had been; but the island had an area of only fourteen square miles in the first place. Because of the small areas they affect, volcanic eruptions can't be compared with continental sinkings of the kind Plato described.

Two kinds of action go to make up an earthquake. First comes a quivering, generally less than an inch in amplitude, but sometimes violent enough to make stones leap from the ground and houses tumble about their owners' heads. The other movement is a slower but permanent displacement of parts of the earth's crust, which may start a tsunami or, if it happens in a city, may break water mains and keep people from putting out the fires that spring up when houses with lighted stoves in them collapse.

The earth's crust, you see, is made up of odd-shaped blocks about five miles or so across and sometimes joined together into thirty-mile-wide super-blocks. These blocks are always moving slightly with relation to one another, but, since they fit tightly together, they cannot slide freely past one another along the

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cracks or "faults" between them. Each block along such a fault is, therefore, slowly bent until its natural stiffness overcomes the friction and it snaps back into shape. During this "snap" the grinding together of the rocks along the fault sets up the vibrations that make an earthquake. The "snap" takes several minutes and leaves the earth displaced on the two sides of the fault, with fences broken and roads offset. Some of the biggest known displacements are:

Place	Date	Length of fault, mi.	Max. horiz. displ. ft.	Max. vert. displ. ft.
Owens Valley, Cal.	1872	40	16	23
Japan	1891	60	12	20
Alaska	1899	?	?	47
San Francisco	1906	190+	21	3
Newfoundland	1929	?	?	35

As a result of earthquakes in 1868 and 1906, the distance between Mount Tamalpais and Black Mountain, California, increased about ten feet. Evidently the geodetic survey people have a never-ending job, for no sooner do they get the terrain accurately measured than the thing gives a shudder and a squirm and changes on them.

You may ask: If the sea bottom off the coast of Newfoundland dropped thirty-five feet and the shores of Yakutat Bay in Alaska rose forty-seven feet, each in a single quake, why couldn't one or a few quakes like that sink a continent? A fifty-foot drop could drown quite an area of low flat country like the Everglades.

However, that theory won't work in practice, because in real earthquakes such large displacements occur only over small areas a few miles across. Moreover a rise in one place usually balances a drop in another, since the blocks on opposite sides of the fault are strained in opposite directions. Finally, records of such submergences in recent times show that they are all local changes. In one of the biggest, for instance, sixty square miles of the Chittagong District of Bengal sank beneath the sea in 1762. That's an area about the size of Staten Island, New York, and less than one-fifth of one percent of the area of Ireland.

Now, *if* there were a large island of very low flat relief, nowhere more than a few feet above sea level, it *might* be possible, for an earthquake greater than any recorded, to submerge several hundred square miles of it at one clip. But before trying to imagine such an explanation for Plato's Atlantis, remember that, first, Plato described Atlantis as mountainous; second, that several hundred square miles is but a tiny fraction of a continent; and third, the island would not disappear, but would remain as a shoal or bank as Plato said Atlantis did. And no such shoal exists west of Gibraltar, though the Carthaginians had told the Greeks that such shoals did exist in order to discourage them from trying to trade in those parts, which

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the Carthaginians regarded as their own private preserve.

Some have thought that Dolphin Ridge, which makes an S-curve down the middle of the Atlantic, might be a relic of Atlantis. However, except for the small, volcanic, and steeply mountainous Azores region, nearly all of Dolphin Ridge is under two or three miles of water, and there is no known way to get a large island down to that depth in anything like the ten thousand years required by Plato's story. Moreover Dr. Ewing of Columbia University has announced that after thirteen years of exploring Dolphin Ridge by sounding, dredging, and lowering a camera and a searchlight miles down to photograph the bottom, he has found no trace of sunken cities.

Besides all the foregoing methods of flooding lands, two other changes will bring about results of the same sort, but more slowly. One is the continual movement of parts of the earth's crust even when there are no earthquakes. For instance the Baltic Sea region is rising at a maximum rate of about half an inch a year, which should leave the Baltic Sea pretty well dry in another one hundred thousand years. Likewise the east coast of the United States is sinking at about half that speed. Up-and-down movements of as much as three inches a year have been recorded in Japan, but these seem to affect only small areas.

Ice ages also change the shape of continents by locking up enough water in the glaciers to lower the sea level. During the fourth Pleistocene glaciation, geologists have figured, the sea level fell between two hundred and four hundred feet below its present level, connecting the British Isles with Europe and Alaska with Siberia. Now, judging from the shrinkage of glaciers, the climate is warming and the sea rising. If the warmth ever gets to the point of completely melting the Greenland and Antarctic ice caps, the world's seaports will all have to move miles inland. Luckily the process takes place only with extreme slowness.

Besides all the forms of change in the earth's surface that we have discussed, there is the common everyday erosion of wind, wave, and rain, the sculpturing effect of rivers and glaciers, and the building and washing away of beaches. Normally these are all slow, noncatastrophic processes, though a big storm can do sizable damage. The 1938 New England hurricane kicked up a surf of forty-foot waves, and a storm in 1099 washed away the small island of Loumea off the coast of Kent, England, converting it into a tidal flat, the treacherous Goodwin Sands. Still, such changes are not extensive enough to show up on most maps.

Then what are the conclusions? That flood legends have a basis in real floods, but that you can't tell much about the real floods from the legends, except that somebody once got very wet. Plato's sinking-continent story is impossible for geologi-

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cal reasons; probably he got the idea for it from true stories of damage by earthquakes and tsunamis in the Mediterranean, plus rumors of islands and shoals in the Atlantic. Earthquakes and volcanic eruptions can not only kill people in wholesale lots, but also can submerge land under the sea. They can only dunk a few square miles at a time, though; nothing of continental size. River-valley floods can submerge much larger areas—even tens of thousands of square miles—and also drown thousands, but these are temporary disasters and the water eventually runs off. Tsunamis also can kill many thousands of people, and flood large coastal areas, but they, too, are temporary in their effects.

The continual movements of the earth's crust and changes in the sea level can dunk or dry really large areas—as much as the whole North and Mediterranean Seas—but the actual movements are so slow—usually a fraction of an inch a year—that the encroachment of the sea would be too gradual to make a flood legend of it. And if any whole continent ever sank beneath the ocean, it must have been so long ago that our ancestors were still sitting on a branch and scratching, and couldn't have created any Atlantean Empire.

One last warning, however. If you are ever lolling on the beach soaking up u-v rays in an earthquake zone—e.g. California or the West Indies—and hear a rumbling sound from the sea, which then recedes for hundreds of yards leaving crabs and fish flopping, run, do not walk, for the nearest high ground. You have from five to thirty minutes before the terrible tsunami arrives!

THE END

Quoted from February 1949 **Tracerlog.**

MERCURY-198 IS NOW AVAILABLE

Tracerlabs is now in a position to supply the stable isotope Mercury-198 to customers interested in using it as a primary standard in Spectroscopic and Interferometer work. This material is produced by exposing purified gold which comprises only the single isotope Au-197 to neutron-irradiation in an atomic pile. Au-197 (2.5 day half life) is produced by a (n, y) reaction and decays by beta emission to stable Hg-198. We have developed a method for extracting Hg-198 from the irradiated gold. Hg-198 is available within approximately sixty days after receipt of an order at a price of two hundred dollars per milligram. The minimum order is one milligram.

Alchemists of old please note!

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COLD WAR

BY KRIS NEVILLE

The proposition in this one, gentlemen, is a dilly. And you are invited to answer the implied question, "Well—what would you do about it?"

Illustrated by Brush

The Government needs YOU!
if
you can qualify

YES!
Space Stations need men!
America's defense has an opening for you!
Excellent pay!!
Generous Furloughs!

Applicants must be between the ages of 24 and 32, and must pass a rigid physical examination. For full particulars, and application blanks visit or write any government post office.

"The President is in conference," the third assistant secretary informed Leland Kreiger.

Leland Kreiger took out his calling card. It contained nothing more than his name and the initials, XSSC, in pica type, in the lower left-hand corner. "Will you hand him this, please," he said. "He is expecting me."

"I'm sorry, Mr. . . . uh . . . Kreiger, but I must know the nature of your business."

"On the contrary; you must *not*," Leland Kreiger said. "I assure you the President will be interested."

And ten minutes later, Leland Kreiger was seated before the President's desk.

The President was a tired man. His face showed it, his body showed it, his eyes showed it. His cheeks were hollow, his shoulders bent, and, under his eyes, there were

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large, black rings. He had been in office only two years.

"Mr. President. Failure."

It was a bleak statement. But the expression on his face never changed. The President took it calmly.

The President sighed. "I should have known. It was the last chance—" His voice trailed off. "You did the best you could. I don't blame you."

"I tried," Leland Kreiger said. There was nothing else to say.

"Did they believe you? Your credentials—?"

"Of course. They were certain I was your direct representative. No doubt about that."

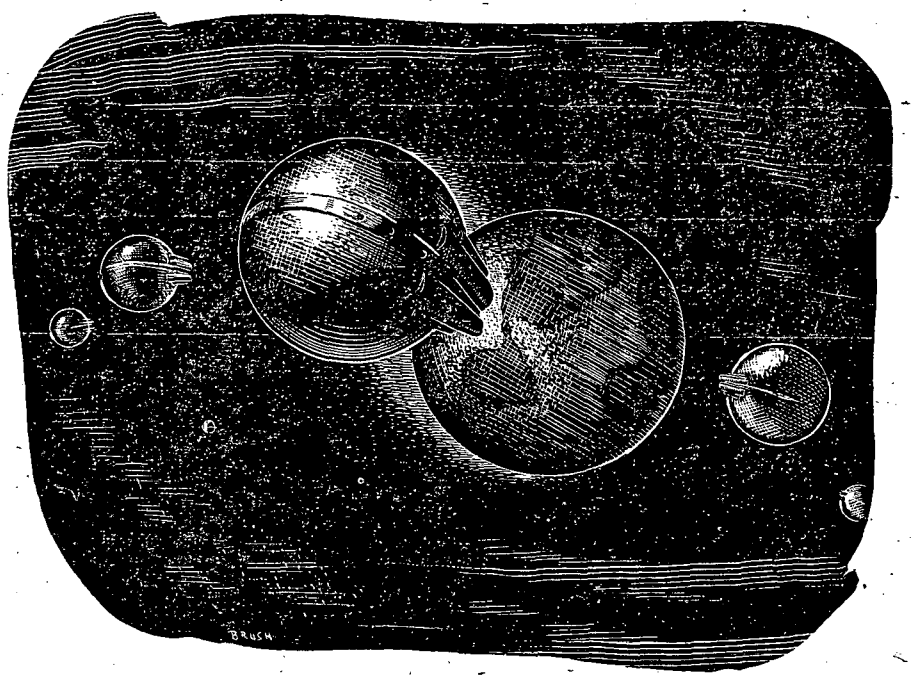
"And they said?"

"That there are things more precious than life; that their people could never tolerate a foreign rule—" He hesitated for a moment, and then added, hastily, "And that we were bluffing."

"I expected it, of course. But I could hope. Now . . . Leland, is there no answer?"

The President asked the last much in the spirit of a man appealing to a doctor who has told him he has but three weeks to live.

"There is only one answer, sir. I was sent to tell them to submit all their armaments to us or we would destroy them. They said it was a



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bluff. The only thing to do is—to destroy them."

"Leland, you know I could never do that," said the President, looking down at his hands. "Perhaps the rulers, yes. But think of the innocent men, women, and children . . . the uncounted millions—"

He looked up. "It's strange, isn't it? If a state of war existed between us, then perhaps I would. But no such state exists. Ostensibly we are friendly nations. I might rouse our people to a point where they would support a war—but I could never justify it. The enemy will go just so far, and no further. They are careful not to give us an excuse."

He paused a moment. "How cruel it would sound: 'He could find no solution but slaughter!' If we used the weapon once, what would the world think? How could we ever *hope* for peace?"

"But, sir, the risk—"

"With one hundred million lives at stake, no risk is too great! What would history say? What would all Christian instinct tell us?"

"If we only had time."

"Time? How I hate that word. Yes, yes, yes. If we only had time—In twenty or thirty years we could discontinue the Space Stations. But not now."

The President looked up at the ceiling. And beyond it. He shuddered.

The President called in Senator Tyler of New York, leader of the opposition in Congress. The President did not like him personally. And, yet, this was not a question of personalities.

"Senator, please be seated," he said, after shaking the man's hand as warmly as possible.

The senator sat down, and, without asking, extracted a cigar. He lit it.

The President set his lips grimly. "I have asked you here on a matter of vital interest to this country. *Vital.* Anything that I tell you today is in the strictest confidence."

The senator leaned back. He did not commit himself.

The President ruffled some papers on his desk.

"I want to stress the importance of secrecy. The newspapers must never discover what I am about to tell you. It would . . . well, it would throw the world into a panic."

"That is very strong language, Mr. President."

The President looked him over carefully. He was a huge man. Fat. Heavy jowls. Tiny eyes. Eyes that glittered with shrewdness.

And the President wished it weren't necessary to tell him.

Outside, unknown to the senator, a secret service man was waiting for him to leave the office. From this day, the senator would be watched every hour of the day and night. His private mail would be opened—his telephones tapped—everything he said and did monitored by the secret service.

And if he started to reveal the

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secret, his life would be extinguished like a cupped candle.

The President stood up. "No, keep your seat," he said. "I assure you that it is not a strong statement." He walked across the room. "Let me ask you once again to call off this investigation. If you were to say the word—"

"Mr. President, that is impossible. The people have a *right* to know," he sucked on his cigar, "that every safeguard is being taken to insure that the Space Stations are manned by loyal American citizens."

If that were only the problem, the President thought.

"Why," the senator went on, "think of what would happen if an enemy spy managed to get control of a Station—he could wipe out half of the United States merely by flicking his wrist." Here the senator flicked ashes onto the carpet by way of emphasis.

Almost automatically the President thought, *Mrs. Thorne, the housekeeper, will be very angry.* He caught himself. Of late his mind had a tendency to rove, and to concern itself with the inconsequential.

The President said: "Let me assure you that every precaution is being taken. Each man is checked so thoroughly that we know him better than he knows himself. *Will you call off the investigation?*"

"NO! You're hiding something, and we are going to find out what! Don't forget that we have the right—"

"You win," the President said wearily. "I was afraid of it. It's not the loyalty check that you want to look into—you're after something else. Something's wrong, and you don't know quite what, but you intend to find out."

"Exactly," the senator said, smiling.

"If you go through with this investigation, it would result in publicity that we could not stand. There is a chance, because you gentlemen are so thorough, that you would discover what I am concealing. To prevent that, I am going to be frank with you. For, after all, one man is easier to bind to secrecy than fifteen. After you hear me out, I am sure that you will call off the investigation."

"I must reserve judgment," the senator told him.

"Very well. But, sir, remember that you have forced me. The responsibility, and the consequences, are yours, and yours alone."

"Naturally," the senator said. "I can look after myself."

The President walked to the wall chart. He unrolled it, and it rustled dryly.

"I am going to cover material with which you are completely familiar. You will forgive me, but it is necessary to stress a few points. But first, are you *sure*—?"

"Get on with it; I'm listening."

"These," the President said, pointing to circles in red on the map,

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"are our nine Space Stations. You will note that they are located so that, at every second, some station is in direct target line with every point on Earth. Due to physical considerations, the stations move very rapidly in their orbits. But this has been made to serve a military purpose. To destroy this defense network, it is necessary to destroy every station, because every station, in its orbit, comes within range of every point on Earth. One might be eliminated, or maybe even two, with our present technical knowledge, but not all nine. And each one, in the space of ninety seconds from a given signal, can blanket an area half the size of Asia with atomic destruction. Each space station *carries enough pure death to annihilate any nation on Earth!*"

He paused.

"It is a perfect defense against an atom bomb. But, at the same time, it is a negative defense. It cannot prevent this nation from being attacked. But an attacker would, at most, launch only a few dozen rockets before he was completely and utterly destroyed.

"And it is our only defense against aggression. It is all that we have. All of our atomic power is concentrated in those nine stations. If they were to be grounded tomorrow, we would be practically defenseless. Any one of several countries could conquer us within the space of weeks."

The President let the chart snap back on its roller.

"In effect, we rule the world. But, as you know, our 'rule' is of a negative sort. We rule by threat." He laughed dryly. "We have something hanging over their heads. They—the enemy, shall I say?—knows that we will never take positive action without strong justification—without what must amount to an open declaration of war upon us, or a definitely aggressive move against one of her weak neighbors. Therefore, the enemy has a wide range of free action. Their only consideration is this: 'Will America use the Space Stations to stop us?', and if the answer is 'no', then they may proceed."

He looked down at the senator.

"The international situation has become pretty much of a touch and go affair. Bluff and counter bluff."

"I know all that," the senator replied.

"You will recall, also, the only time that we used a Space Station. The whole world shuddered."

"Of course. Who doesn't remember? Russia was bent on setting up a Space Station of her own. We warned her. But she thought it was a bluff. The day they were ready to launch it, we dropped a single bomb on it. After all, we couldn't permit another nation to have a Station. It would be intolerable."

"Yes," the President said, musingly, "one tiny bomb. Not an attack—but only one bomb. And yet the feeling ran high against us. Both here and abroad. The people of the world felt that surely some other

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means could have been found. Not involving death!"

The President sighed. "It postponed for ten years at least the day when we would no longer need Space Stations."

The President walked over and sat down.

"Russia, you will remember, protested to the U. N. She wanted the Stations placed under international control. We could not permit that, because, primarily, the Stations are not a method of enforcing peace, but of defending our own country against any and all aggressors. Russia could take no further action—for she existed only under our sufferance. She had merely gambled and lost."

"I, and any high school child," the senator said, "know that. Please come to the point."

The President ignored him. "The whole problem of Space Stations is too much for one man. I wish that I had never heard of them!"

The senator put out his cigar.

"Well, senator, let me review.

"You realize that Space Stations are our only defense?"

The senator grunted. "Yes."

"And that we cannot use them offensively against an enemy unless she gives us ample justification?"

"Yes."

"And do you know that if we discontinued them, we would be attacked tomorrow? By a nation who would absorb a calculated amount of destruction in order to dominate the world—by a ruthless enemy, an enemy who bears us not the slightest love?"

The senator snorted.

And the President smiled. "Of course," he said, "we could surrender to the enemy."

The senator jerked upright. It was an effort that made his face red. "Man, do you realize what you're saying!"

"Calm down," the President advised. "I know my oath of office as well as you do."

He hesitated a moment while the senator settled back somewhat uneasily.

"What I have done is merely mention various alternatives that would confront us if we decided to discontinue the Space Stations. Bloodshed or subjugation. The alternatives are all untenable."

"Naturally," the senator said.

"But I must discontinue the Space Stations," the President told him as mildly as if he were mentioning that eggs were on the White House breakfast menu for tomorrow.

"That will be impossible for many years," the senator said with equal mildness.

"Oh, but I don't have many years, senator. In fact I don't have any time at all."

The President got up again and walked over to the far wall and stood looking at a picture of President Lincoln. He put his hands behind his back and seemed to be talking,

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not to the senator, but to the picture, "Now you can begin to appreciate my position."

Adam Kregg had, for a long time, been covering the national picture, as it looked from Washington, in his daily column. Recently he had been writing on the seriousness of the military situation, and of repeated rumors "from high official sources" that the United States was planning to attack the enemy without warning. He deplored these reports, as a matter of course. He pointed out that, at present, we were in no danger; indeed, that we were able to keep peace, although an uneasy sort of peace, and that since affairs couldn't get worse, they were bound to get better. "It is possible," he wrote, "that within the next twenty years, if we continue on our present policy, differences between both nations may be resolved. At any rate, it is obvious that we can gain nothing by the use of force; it can only result in needless bloodshed. It is not justifiable. Eventually every nation will see, by our judicious use of the Space Stations, that we do not seek to rule, but that we do seek to live in Peace, unmolested by *any* aggressor."

Undoubtedly, Mr. Kregg had the welfare of man at heart. However, he was, first and foremost, a reporter. He had an unfailing nose for news. He could put 2 and 2 and 2 and 2 together every time and come up with the correct total. A hint here, a word there, an omission elsewhere, and Adam Kregg had a scoop.

Washington was honeycombed with his sources. And nothing was sacred. If it was startling, if it would set well in type, then Mr. Kregg put it in his column.

Several times he had roused the wrath of the government. They called him irresponsible. Others called him a brave and fearless reporter. And his motto was "All the News". Period. He would rather chop off his two hands than suppress a story.

To him nothing was confidential. Everything was grist for his mill.

Once the government sought to bring a criminal action against him. The nation's press took up the hew and cry: "If convicted, this will mean the end of a free press in America".

And Adam Kregg went happily on his way, reporting "all the news". That is, until he happened across the most closely guarded of government secrets.

Perhaps he deduced it. Perhaps someone told him. At any rate, he found out.

It was shocking. It even stunned him. He became frightened. And then he saw the story in headlines—the nation and the world thrown into the same state of terror that he was in. Naturally he decided to print it.

He was going to give it to the great American public. But if not in print, then by some other means.

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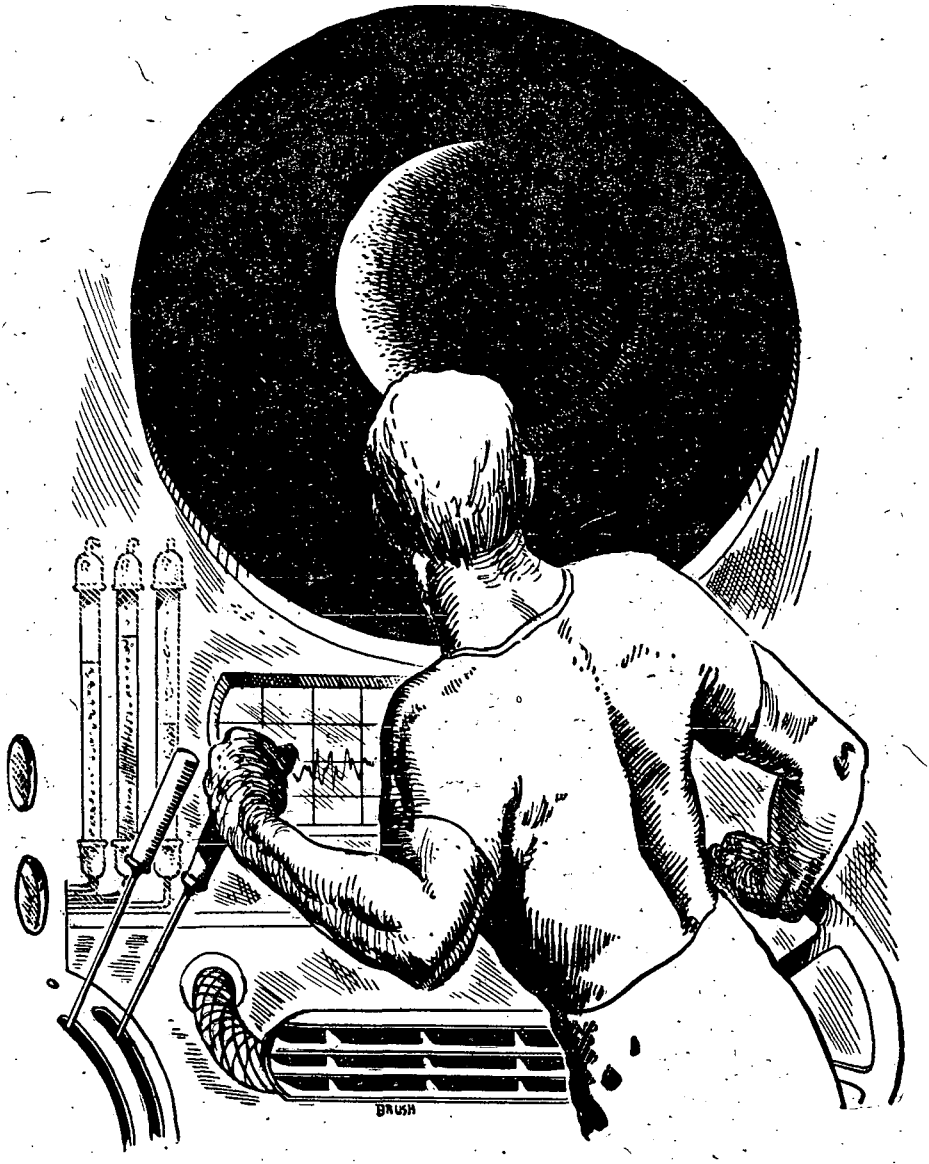

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That was that. Arrest him, and it would come out at his trial. Any action the government chose to take, *still* the people were going to be told.

For, as Adam Kregg knew, he lived in a democracy. And the government tactics did not include—

He tucked the column into his coat pocket. He was going to take it to the syndicate personally. He was going to see it go out over the wires. And nobody was going to talk him out of it. It was the scoop of a lifetime. Maybe ten lifetimes. Better, even, than when the reporter had discovered, during the last war, that the Government had broken the Japanese code.

He got into his car and drove crosstown to the syndicate branch office.

He got out and started across the sidewalk.

A huge, black car hurtled around the corner and flashed by him. Two shotgun blasts erupted from it.

He fell, his chest torn away. He squirmed once and died.

Almost immediately, a plain-clothes agent was bending over him. The man removed the bloody sheaf of typed paper. He stood up and flashed his badge to the crowd.

"This man is dead," he said.

And a policeman came running up.

The FBI seized all of Adam Kregg's personal papers. They told the press that they were looking for clues.

And there were headlines:

FBI STARTS INVESTIGATION OF ADAM KREGG'S DEATH!

But the assassin was never found.

Adam Kregg failed to realize that the secret was too big to protect by normal, democratic procedures.

"It's a neat legal question," the Chief Psychiatrist admitted. "But you know very well we can never bring the case into court!"

The President agreed. "You're right, of course." He looked off into space. "And I hate it! The way it forces us to abridge all human rights—"

The Chief Psychiatrist nodded grimly.

"Well?" the President demanded. "Can't you *do* something? Isn't there any test? Anything?"

"No." The Chief Psychiatrist looked away. "There is no way of telling who's susceptible and who isn't. Frankly, we're puzzled. The first case came up a little over a year ago. This is the fifth. Each case follows the same pattern . . . I . . . well, that's all we know."

"How is the man now?"

"Aside from the memory blank, completely normal."

"And what do you recommend?"

"We can't take the case to court. As it stands, of course, we can't release him. If for no other reason than security. It's obvious that he can't be held accountable—but, as I said, that's a neat legal question.

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And, we must remember, that the condition may return at any time."

"Well?"

"Wait and see. What else *can* we do?"

There was a momentary pause. "Mr. President, I'd like to have you see for yourself what you're up against. Come and look at the patient."

The President stood up. It was the last thing in the world that he wanted to do. But after all, this whole mess was his responsibility.

The patient was isolated in a cell block of the Federal Prison. He was sitting on his bed in the far cell.

The keys grated harshly as the jailer admitted the President and the Chief Psychiatrist.

The patient stood up. His face was pallid. Tight anguish lines laced it. But it was still a handsome face—young, strong, tanned. The eyes were red rimmed, as if the man had been crying. Blond hair spread in an unruly thatch.

The President walked slowly to his cell.

The patient looked at him for a moment without recognition. Then the red circled eyes seemed to light up.

"You're . . . you're the President!" he gasped.

"I am," the President said, gently.

"I . . . I," he began and then stopped with a choke. Suddenly a wild look came into his eyes. "Why have they got me here?" He grabbed the bars and shook them. "Why? Why? WHY?" He sobbed. "Why won't they let me see my wife and baby? Why won't they let me see anybody? You're the President," his voice began almost to whine, "surely *you* can tell me. What have I done?"

He banged his fists on the bars.

"Tell me! Tell me!"

"Here, here," the Chief Psychiatrist said. "Control yourself!"

"I'm . . . I'm sorry. But why won't somebody tell me anything? I . . . I want to see Doris." He turned his face to the President. "That's my wife, sir. And Jerry. That's my baby—cutest little kid. *Why won't they let me see them?*"

He began to cry.

The Chief Psychiatrist touched the President's arm. "Let's go," he whispered. "We can't do anything. It's shock."

They turned and started to leave.

"NO!" the blond youth cried. "Oh, no! Don't leave me. Don't leave me here alone." He began to sob. "I'm afraid . . . afraid . . . afraid—"

"Doesn't he remember?" the President asked when they were out of the cell block.

"Doesn't seem to. He must have established a subconscious block. There is no conscious memory for the whole period."

"How do you explain it?"

"I can't. And what makes it more horrible, it happened after that poor

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kid's first tour of duty. Now we know it isn't necessarily the time element. And that's about all we know.

"Our tests are as perfect as human science can make them. We may screen as many as ten thousand applicants before we have found one who is qualified, even, for the solitary test. I'll bet we've screened half of the available men in America. We have been so selective that, if we went one step further, we could qualify no one. And yet—there is the human element there, that eludes us.

"There still remains those men upon whom the Space Stations act as a drug. Like marijuana. They seem to tower above mortality!

"And all that responsibility, all that tension—so many lives at their fingertips. And the suspense—what, with the way the newspapers are playing up the international situation—sitting there, waiting, waiting, waiting. Listening for that deadly signal. Waiting to punch the controls that will destroy one hundred million people. One-hundred-million! And the tension mounting as they swirl over enemy territory . . . the flood of relief over their own—" He paused.

"I can imagine what the poor devils must think. Life and death . . . *life* and death . . . life and *death*—Over and over, producing a hypnotic effect—like the individual death-wish. And the mind falls into that pattern—starts working like a pump."

He paused for a moment. "And then there is the second stage. 'Suppose I should push this button here, what would happen? would *happen?* would h-a-p-p-e-n? Or this button . . . or this— Life *and* death. And one-hundred-million people . . . living . . . loving—'" He stopped. "You see?"

"I—see," said the President.

"No wonder they break. All the world, all that living, there, at their fingertips—" He sighed.

"All five of the men waited until they were home on furlough before they snapped." He snapped his fingers. "Like that! And all followed a pattern—like that poor boy in there, taking a butcher knife to his wife and kid. Insane—criminally insane. Or the one before—"

"Don't!" the President ordered, closing his eyes. "Please. No more."

Then after a while, he opened his eyes again and looked upward.

The law of averages, he thought, is catching up with us. Five on furlough. And swirling in one of those nine orbits, up there, is a man who may, at any moment, become . . . just like the five . . . murderous . . . insane!

And in each of the Stations there is enough power to destroy half a continent.

THE END

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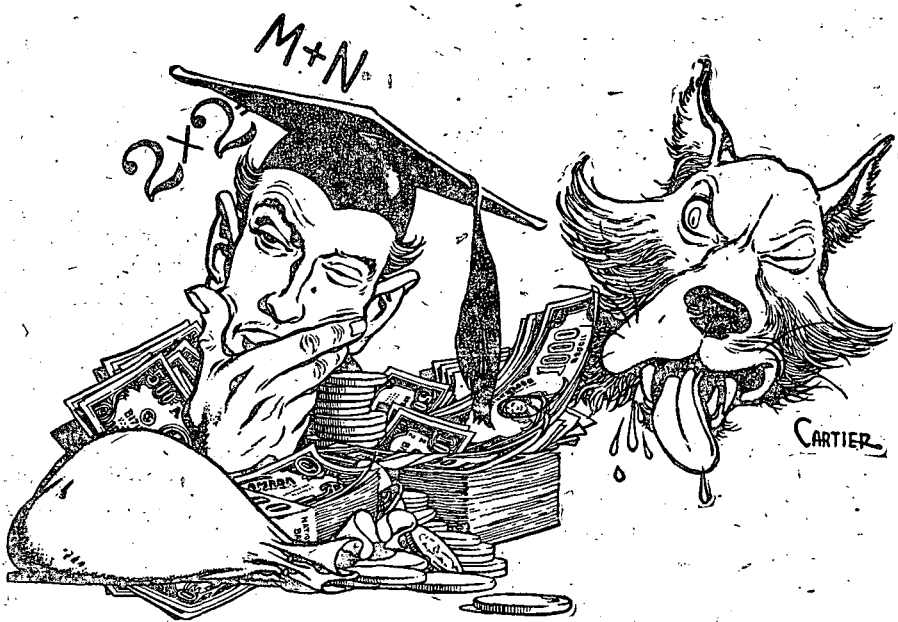

THE FINAN-SEER

BY E. L. LOCKE

The speaker went on. And on. And on. "... I want to remind you that I am the only real business man among you. I am the only one here that ever met a payroll and so I know just how to handle this situation. Now when I was running my butcher shop in Carteret, New Jersey, I found ways and means to keep my business solvent. I tell you it was a tough job because it was a credit store and you should have seen how many of my customers were deadbeats. I—"

A quiet but sarcastic voice cut in, "I don't doubt that the Professor of Meat Cutting was able to devise ways and means. After all, I understand the high incidence of corpulence among butchers is not entirely accidental. Large stomachs have their uses in the weighing process."

A beet-red color suffused the face of the first speaker and strangling sounds came out of his throat. Before he could collect himself to retort, a silver-haired, dignified-looking man got up from the head of the

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Illustrated by Cartier

When professors try tackling the Wall Street professionals, a good job of trimming is to be expected. But in a way, this is a deus ex machina *story, at that—*

conference table and said: "Gentlemen, let us stop this bickering. Your remarks, Professor Bronson, were uncalled for, and I think you owe Professor Schultz an apology. On the other hand, I am afraid that Professor Schultz's business experience is not precisely the type that will extricate Trent University from its troubles. Let us review the problem briefly and see if this time we can get some constructive suggestions.

"The roots of our problem extend back several years. Our endowment fund at that time was invested entirely in government and utility bonds. The steady decline in interest rates forced our trustees to seek higher yields. Since a number of them belong to . . . ah . . . the financial fraternity, they convinced the other trustees that the thing to do was to invest in common stocks."

At this point he was interrupted by the physicist, Professor Andrew James. He was an unusually young man to hold a full professorship, being still in his middle thirties. He held the newly created chair of Applied Physics in tribute to his abilities as an idea man who had established a solid reputation in industrial work. He asked: "What was wrong with that, Dean Fairbanks?"

"Why nothing, Professor James, as a matter of principle. The income was raised quite appreciably—for a time, that is. Then we were hit by what appeared to be a minor recession, and then the trouble started."

Professor James interrupted again: "I thought these Wall-Streeters knew all the ins and outs. Why didn't they sell short?"

"The answer to that is that their statisticians told them that a turn was coming and so they hung on. As a matter of fact, our Department of Economics was consulted. I understand that they arrived at the same conclusion after applying the best mathematical techniques. Why, I believe that they analyzed the past performance of the market by applying the theory of Fourier Series, and then extrapolated the result." He added wryly: "The results were rather unfortunate.

"Then, in desperation, the trustees started to . . . er . . . switch, I believe they called it. However, their steps were dogged by misfortune. Recently I was informed that unless the university can recoup its losses, we shall be forced to curtail our operations. I therefore called this meeting of the faculty to see if there were any ideas for extricating our

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university from its financial morass." Then he added with a wan smile on his face, "After all, gentlemen, college professors are popularly believed to be profound thinkers. Let us at least make an attempt to validate that belief."

Professor James spoke up again: "Suppose that we do come up with a solution. What guarantees have we that the trustees will not reject our solution as the impractical dreamings of 'long hairs'?"

The dean looked thoughtful for a moment before replying: "I do not want to trespass in the domain of our colleagues in the Department of Applied Psychology, but it did appear to me that our trustees are in such a desperate position that they will clutch at any solution. Then he smiled a bit and continued, "I can just see the headlines in our sensational press. 'BROKERS BREAK COLLEGE.' You can imagine what that would do to the fast vanishing reputation of financiers for astuteness."

A mild-looking man of slight build, apparently in his fifties, spoke up rather hesitantly, "I must say that I am disappointed that my friends in Economics thought that Fourier Series were appropriate to this sort of problem. I had the impression that Economics was not an exact science and that the mathematical techniques used were rudimentary, but it does shock me a bit that they were that naive."

The mathematician had addressed his remarks to Professor Johnsrud of Economics. The latter was a large man who secretly cherished a slightly physical resemblance to the late J. P. Morgan. He had often felt that the resemblance was more than one of appearance. Given a slightly different set of circumstances, he often reflected, he could have matched Morgan's financial achievements. Thus, though he was a man of undoubted ability, he tended to overestimate it and was quick to resent any apparent slights. Accordingly, he jumped to his feet and spoke with considerable asperity: "Newcomb, I believe that someone, a mathematician no doubt, once claimed that God must have been a mathematician. You mathematicians have never forgotten that. Let me remind you that the converse of that proposition is not true. It is easy to be wise after the event. What would you have had us use?"

"My dear Johnsrud, I did not intend to hurt your feelings. It does seem to me that you might at least have used the Theory of Stationary Time Series. In the last war the theory was well developed in connection with the problem of predicting the future position of enemy aircraft, when the data on its present position was distorted by extraneous disturbances."

Johnsrud was still sulking when he asked: "And how far ahead were they able to predict with this wonderful mathematical tool?"

"Oh, about two seconds, if my memory serves me correctly."

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Johnsrud smiled in a superior manner, slowly swept his glance around the conference table and merely said: "I thought so."

"That does not invalidate the principle of the thing. I want to add that since then we have acquired an even more potent attack on just such problems. I am referring to the book by Morganstern and von Neuman, 'Theory of Games and Economic Behavior.' It seems to me that we should exploit the possibilities of this viewpoint."

Professor James spoke up: "The last part of the title seems as though the material may be apposite. Can you tell us a little something about it, Professor Newcomb?"

"I am afraid that anything I can say at the moment would not convey an adequate impression of the depth and scope of the method. Briefly, in most games and, of course, in all business deals, the opponents have incomplete information. For the sake of simplicity let us say that there are only two players. Player A has a number of courses of action open to him at any given stage. For any specific course he knows that his opponent B has the choice of a number of replies. A then calculates what his chances are for any one of the possible replies B can make. A then assumes another of his possible courses of action and again calculates his chances for all possible replies B can make, et cetera. Of course, B is assumed to be doing exactly the same thing. Each player can, on the basis of his calculations, use the strategy that makes his probability of winning a maximum. Is that clear, Professor James?"

"Not exactly. Can you give a simple example?"

"Yes, I believe I can, if I may have the use of the blackboard. This example was devised at Princeton precisely for the purpose of providing a simple illustration of the principles involved. Assume that each of two players has a red ace and a black ace: A also has a black deuce and B a red deuce. The players match cards for color. The rules are that if the chosen cards have the same color B pays A and vice versa, except that, if both cards are deuces, it is a draw, and if both cards are aces, payment is one unit; with ace against deuce, two units. The scheme of payments is shown in the table I am now putting on the blackboard."

		Black ace	Red ace	Red (B) deuce
	Black ace	1	−1	−2
(A)	Red ace	−1	1	1
	Black deuce	2	−1	0

"For instance, if A plays his black ace and B does likewise, A wins a point; if on the other hand B should play his red ace or his red deuce, A pays B one or two points, respectively. Suppose that this game goes on for a long time, what do you think the strategies of the respective players will be, Professor James?"

"I would say offhand that the play should be at random, since the table indicates that this is a perfectly fair game."

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"You are mistaken, Professor James. This is a crooked game, despite appearances. With the best strategy B can devise, assuming that A does likewise, B will lose a fifth of a point per game in the long run. A's best strategy is to play his red ace three fifths of the time, his black deuce two fifths of the time, and his black ace not at all. On the other hand B should play his black ace two fifths of the time, his red ace three fifths of the time and not play his red deuce at all. Of course, the real problem is how to find these fractions."

He turned toward James whose face wore a puzzled look, and continued: "Maybe it would be better if I showed you how it works out for the random play you suggested. Suppose A thinks his best strategy is to play each of his cards one third of the time. Suppose he guesses that B will play the black ace. If A plays the black ace, he will win one third of a point. If he plays the red ace, he loses one third. Finally if he should play his black deuce, he wins two thirds of a point. Thus on the assumption that B plays the black ace, A's long run expectation is a win of two thirds of a point per game. But remember, B may not be playing at random. If B should play his red ace, the same type of calculation shows that A's expectation is now a loss of one third of a point. Similarly if B plays the red deuce, A again stands to lose one third of a point. Now A has the right to assume that B will try to play as intelligently as possible. It follows then that if A plays at random and B plays intelligently, A can expect to lose one third of a point on the average. What A has to do is to figure out his line of play so that the smallest of his expectations, no matter what B does, is made as large as possible. It turns out that the best strategy for A is that which I first mentioned, namely zero, three fifths, and two fifths. Of course B can do a similar calculation but he finds to his sorrow that his best strategy, namely, two fifths, three fifths and zero still loses one fifth of a point per game."

Johnsrud had listened carefully but nevertheless managed to sound bored as he spoke up: "This is all very interesting, no doubt, but how is this to help us? Did you have in mind that the university should send us to participate in floating crap games?"

Newcomb smiled and said: "You know, that never occurred to me. Maybe it isn't such a bad idea. What I had in mind was that you could figure out a way to apply this to operating in the stock market. You know the various factors that enter into stock movements, and I thought you could list these factors and make up the required matrix." Then he added rather plaintively, "At least I assumed that you could do it."

Johnsrud rose to the bait and snapped out: "Certainly I can do it. But it seems to me that you can not make a big killing in the market with

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this scheme, and that is exactly what we need to do."

Professor James cut in at this point: "Are you quite sure that that is a necessary assumption? It seems to me that our real trouble is that the loss in dividends has cut into our income. Therefore, I think that all we need to accomplish is to win an amount which is equivalent to the normal yield of the stocks."

"Well, perhaps you are right, Professor James. I shall get to work at once and set up the matrix. Why I can think of dozens of factors right now that would go into it and I don't doubt that when I buckle down to work I may find as many as several hundred." Then his face did a double take. "Something just occurred to me. From the example you gave, it seems to me for a complicated problem a lot of computing will be necessary. Who will do this work, Newcomb, and how long will it take to solve for the best strategy?"

"I must confess that I had not given that phase any thought. I assumed that the two computrices we have in our Statistical Laboratory could do it on their Monroes. As to the time required, let me think. If the matrix is MxN, there is an $M^{+}N$ fold infinity of combinations to be tried; but, of coures, we have to worry only about our end. That reduces to an M-fold infinity which should help a lot. Then I have in mind certain theorems which would permit us to converge on a solution. All in all, I should say it would take several years of computation."

The answer left Johnsrud thoroughly exasperated and his tone showed it. "You propose a scheme that will take several years to evaluate the strategy for a single day's operation! It is now my turn to say that while I knew that mathematicians were naive I did not think that they were that naive."

Professor James stepped in again at this point: "Really, gentlemen, there is no need for recrimination. I believe there is a way out of this. As I see it, you, Professor Johnsrud, agree that the idea is basically sound and the only problem is to get the computation done quickly. Why not make use of the electronic calculator our department is working on? I believe it is now being de-bugged and should be ready for use soon."

"I must admit," said Newcomb, "that the use of a machine had not occurred to me. I don't believe in them, you know, at least not for mathematics. However, in the case of necessity, such as now existing, I should remain open minded."

Dean Fairbanks had been following the argument with intentness. When he saw that three of the best men were in essential agreement, he thought that the matter had better be acted on at once. So he rose to his feet and said: "Gentlemen, it begins to look as if a possible solution has been uncovered. I suggest, therefore, that Professors Johnsrud, Newcomb, and James constitute themselves a committee to act on this proposal. Let me know when you have worked out a *modus operandi*,

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and I shall take up the matter with the trustees. As I intimated before, there shouldn't be any difficulty on this score. Now unless someone else has a comment to make, I shall adjourn the meeting."

Excerpt from Shell's column in the New York *Tabloid,* November 2nd.

This scribe has heard that a certain university, not so far from here, is in financial difficulties, the trustees having lost the university's shirt in the stock market. It is now rumored that the long hairs have taken matters into their own hands. They have cooked up a scheme to play the market with the aid of a mechanical brain. The wolves of Wall Street are said to be licking their chops in anticipation. Will someone kindly have a barrel ready for our long-haired friends?

Excerpt from Shell's column in the New York *Tabloid,* February 17th.

It was this scribe who first tipped you off that a certain university was going to try its luck in the stock market with a mechanical brain. The brain, which has been named "ANDROID"—to you lugs, A Numerical Dopester Robot; Operations Investigated and Developed—is apparently a lot smarter than the Street credited it with being. Your scribe has heard that it has been taking the Market to the cleaners to the tune of two hundred Gs a day. Save that barrel, the wolves may need it.

Professors Johnsrud, Newcomb and James marched into Dean Fairbanks' office. He waved them to chairs and after they had settled themselves, said: "I called you together so that we could review our recent operations in the stock market. It is almost time for my report to the trustees, and I wish to be well armed with facts."

Professor Johnsrud glanced at his colleagues and interpreted their silence as an invitation to act as spokesman. He cleared his throat and said: "If you had asked that question yesterday, I would have said that our operations are completely successful. Today, I am not quite so sure."

The dean's raised eyebrows prompted him to continue. "You see, Fairbanks, since the machine operates on a probability basis, a plot of our operations against time is not a smooth curve. We have a winning run, followed by a losing one and so forth. Of course, the integrated effect of our operations is easily known. All that we need to do is to look at our running profit and loss account. This shows that our average daily profit has been about twenty thousand dollars a day."

The dean interjected, "I was aware that you have done very well. In fact our financial embarrassment is a thing of the past. Just why are you worried, Johnsrud?"

"I am not really worried. It is Newcomb who thinks that we are in trouble. Perhaps he had better tell you about it."

"You may remember that, when we first considered our financial difficulties, I pointed out the existence of a mathematical technique

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known as the 'Theory of Stationary Time Series.' I mentioned that it was used as a means of predicting the mean trend of fluctuating phenomena. Out of curiosity, I applied this theory to the data of our day to day operations. I calculated the auto-correlation function and if I interpret it correctly, our mean trend has reversed. On the basis of this I think we shall lose a considerable sum unless we act at once."

The dean turned to Johnsrud. "I take it that you are not in full agreement with Newcomb's views?"

"That is right. There may be something in what he says. I would not care to reject his findings outright. If there is one thing that my years of experience with economic phenomena have taught me, it is to look out for the unexpected. However, I find it difficult to share Newcomb's pessimism because, after all, just look at our comfortable bank balance. Besides, I'm sure my matrix takes every important factor into account. I therefore suggest that we let matters go on for the present and see if this trend really shows up."

The dean turned to James. "Do you have any definite views on this matter?"

"No, I can't say that I have. I have no physical intuitions concerning it. While I have a lot of respect for mathematics, I still have a vague distrust for statistical methods, except of course, in Quantum Mechanics."

"In that case," said the dean, "suppose we wait and see. Good day, gentlemen."

Excerpt from Shell's column in the New York *Tabloid* April 1st.

News has reached this scribe's ears that the battle of wits has turned against Android. The super-brain has been taking a shellacking from the wolves. Does anyone here want to buy a certain university cheap?"

It was late in June and the campus seemed deserted except for a pair of men walking slowly, engaged in conversation.

"Whatever gave you the idea, James, to do what you did? If I may say so, it was a masterpiece of reasoning."

"Thanks, Newcomb, but I really can't claim that it was pure reason. Actually it was something in my subconscious that put the factors together. Are you familiar with Heisenberg's Uncertainty Principle?"

The older man nodded. "Yes, but what does that have to do with it?"

"Just this. Your use of the Stationary Time Series theory predicted that we were going to lose our shirts. Later events amply justified your predictions. I was mulling over our troubles and was getting nowhere in finding a solution. Just to relax and turn my mind into other channels, I picked up a text on Quantum Physics and started reading. I happened to open to the chapter on the Uncertainty Principle. There was a description of that old problem, the determination of the position and velocity of an electron,

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using a radiation probe. You know the answer to that one. The radiation reacts with the electron and gives it a kick."

"I think I see. You mean that our machine was perturbing the market?"

"Exactly. I then searched through our matrix and found that we did not include a factor for the perturbing effect. Since we felt that our operations were on a relatively modest scale, it did not occur to any of us that such a factor should be included. However, the newspaper publicity exaggerated the effectiveness of our machine. I believe Shell, the news columnist, claimed our winnings to be two hundred thousand dollars a day. Actually it was about a tenth of that amount. As a result, professional market operators formed pools more frequently than normal, and this had the effect of introducing new factors for which we had made no allowance.

"The answer was obvious. All I had to do was to punch into the memory a set of instructions that the matrix should be modified by the machine itself, so as to make the predicted auto-correlation function positive. However to make the machine's job easier, I included a new row and column in the matrix to take care of the Shell effect. And that is all there was to it."

"That may be, James. I still feel that it was a great idea. Our troubles are over now."

"Yes, and now that we are on sound financial ground, we should pull out of the market rather soon. We shall have to do it in any case, within say six months. I suppose you have heard what is happening?"

"No, I don't think so."

James chuckled a bit and said: "It is a perfectly natural thing. We have built a better mousetrap and the rest of the world is copying our design. Several groups of operators have placed orders for their own electronic calculators. When these are delivered, we shall no longer have an advantage. If we should still be in need of money, maybe we shall have to take up Johnsrud's suggestion and play the floating crap games." He paused a moment and added in great good humor, "An idea just came to me. How would you like me to fix you up with a miniature transceiver, disguised as a hearing aid? We could send you to participate in those floaters. The players' bets would be picked up by the vest microphone and the machine would feed you the betting odds through the earpiece. Just think what a wonderful setup it would be! No? Well, I suppose not. To change the subject slightly, there is something that still bothers me. You remember that three-card game you used as an illustration?"

"Yes. What about it?"

"Just why is that a crooked game?"

THE END

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BOOK REVIEWS

"Darker Than You Think," by Jack Williamson; Reading, Pa., Fantasy Press, 1949, 310 pp., $3.00.

Ever wondered why men have always feared witches? Jack Williamson gives you a startlingly plausible explanation in his novel "Darker Than You Think."

This outstanding fantasy, which first appeared in *Unknown* in 1940, has excellent plot design, fast-moving action, and suspense which explodes into high-tension horror. Will Barbee's assignment to cover the return of Dr. Mondrick's expedition to the Gobi Desert seems routine enough until he meets a spine-tingling, red-headed girl cub reporter at the airport. A moment later as four apprehensive scientists unload their anthropological finds, their leader mysteriously chokes to death before he can complete a statement to the press. When Will asks the green-eyed beauty about the strangled kitten in her bag, she confides quite simply that she is a witch. From here the story moves with ghastly logic to a strange, unexpected end.

In expanding his tale for book publication, Williamson has worked out an inspired explanation of how witches make their evil spells effective. You see, witches have always known about the laws of probability. They wait patiently until their victim gets into a situation in which an accident could easily happen. Then they grasp the probabilities, exert their extra-human power, and bring about the desired outcome.

That is why the materialists among us can jeer at their more mystic fellowmen who believe in witchcraft. A materialist can point out that Dr. Mondrick had an acute attack of asthma brought on by cat dandruff; or that Rex Chittum ran off the road because he was driving a rattletrap car on a dark and bitter night across a dangerous mountain. And the witches count on materialists with their reason or ridicule to keep the more sensitive minority from hunting down the witch folk.

Even if you remain an unsuspecting materialist, you will take your hat off to the author for his arresting assumptions of how witches operate; for his rich background of historical information on the subject of witchcraft; and for one of the very best yarns in the fantasy field.

Catherine C. de Camp

"Skylark of Valeron," by Edward E. Smith, Ph.D. Fantasy Press, Reading, Pa. 252 pp. Ill. 1949. $3.00.

This third and last of the "Skylark of Space" epics linked the pioneering period in science fiction with the early days of this magazine, and opened the way for the expansion

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and development of the Smith formula in the "Lensman" stories.

Such writers as Edmond Hamilton had tossed suns around and brought together *outré* races before Richard Seaton and his friends began their breath-taking junket through space and the fourth dimension, but the "Skylark" stories, from the very first, had a simple reasonableness about them which made their advent a milestone in science fiction. Their detractors call them "Rover Boys stuff", and sneer at plot and characterization—but they read them.

In this third of the "Skylark" triology, the supposedly dead Blackie Du Quesne, arch-villain of the first book, turns up as diabolical as ever and takes advantage of Seaton's wanderings through unimagined fastnesses of the universe to seize domination of the Earth. Seaton, fighting off disembodied "pure intellects", fourth-dimensional sea horses, and chlorine-based amoebae of another galaxy, pushes his colossal overview of the structure of the universe down into a sixth order of "vibrations" and upward to a panorama of the metagalaxy.

A. J. Donnell's initial-vignettes have become a feature of the Smith yarns. These for "Skylark of Valeron" are among his best work, and fit the fabulous spirit of the book perfectly. Every collector must have the book, and any reader who enjoyed the earlier stories of the series must have this climactic volume, too.

P. Schuyler Miller

"The Wheels Of If," by L. Sprague de Camp. Shasta Publishers, Chicago. 1949. 223 pp., $3.00.

All of the seven representative examples of de Campian whimsy and reverse plot-twists in this new collection are from this magazine and *Unknown Worlds*. The title story, longest of the lot, is another typical de Camp adventure with an alternative future wryly reminiscent of certain episodes in our own history. "The Contraband Cow" offers thoughts on the possible consequences of a world government in which lobbying has not been eliminated as the principal directive of legislation. Stories like "The Merman" and "Hyperpelosity" may be considered, in quasi-musical jargon, variations on themes, idea-stories; or s'posin' yarns.

Although part of the flavor of these stories comes from the odd ideas on which they are based, basically they are good because of what the author has done with his themes. Astounding SCIENCE FICTION was at one time famous for stories of this kind; it has never quite found the same formula, although with de Camp back in the writing business the "good old days" may recur. Meanwhile you can do no better than to put this collection on your shelf. The bright, doubtless symbolic, and altogether puzzling wrap-around jacket by Hannes Bok will make anyone reach for it, and the first look inside will do the rest.

P. Schuyler Miller

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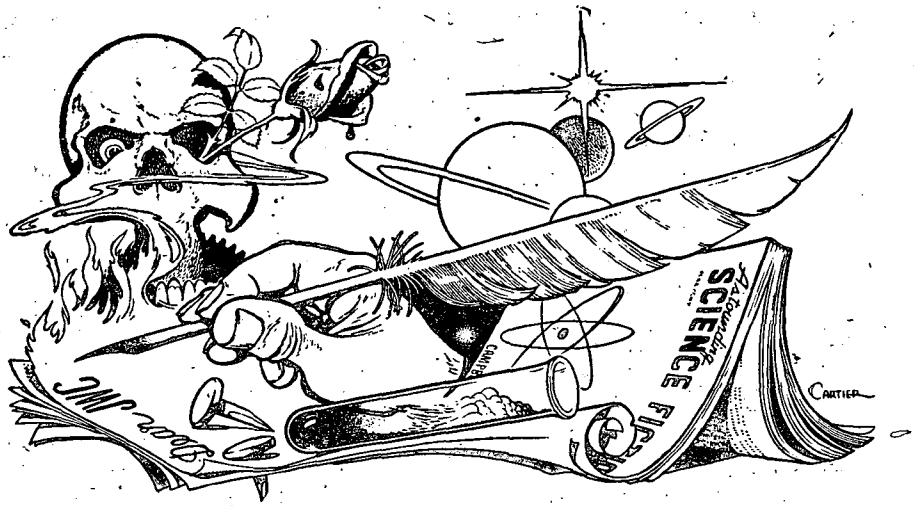

BRASS TACKS

What would you like articles on?

Dear Mr. Campbell:

With every issue, the 1949 Astounding grows better and better. Beginning with the rather less than mediocre January and February numbers, Astounding has steadily improved until, in this May issue, we find four stories that can only be described as splendid. Here is my rating:

1. "Needle" (I). This story is all that it was said to be, and more. Here we have the deep-space atmosphere, the dramatically dangerous alien invasion situation, and the warmly gratifying and absorbingly interesting problem of the friendly contact of two alien races—all woven together to make a superb tale. All three of these themes have always been popular with me, but never until now have I seen them combined. This was one of the most absorbing stories I have ever read. The complex network of vast subjects is so capably dealt with that one is scarcely aware of the difficulty of the task. Perhaps the best thing in the serial so far is the surprisingly human qualities accorded to the Hunter. He can even become petulant and exasperated, along with all his more alien virtues and handicaps; and you could count on the fingers of one hand the number of other nonhuman characters in s-f who have had such delightful and unbelievable qualities, as revealed by their creator.

2. "Prophecy". Between the su-

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perlative "Needle" and the mediocre "The Conray Diary" there are three stories so close together that it is almost impossible to decide how to place them. "Prophecy", though short, is really good, and I have finally decided to place it second. It was very effectively written, and, with one reservation, I agree with Anderson's very realistic concept of the effect of aliens on indigenous planetary cultures, though I know that it pokes holes in a number of attractive theories. If the alien people have sufficient mental power to change the inherent intellectual and emotional characteristics of those they encounter, the situation described in "Prophecy" would not exist; but it is very true that such aliens would be the very extraordinary exceptions rather than the rule.

3. "Mother Earth". Another very excellent piece of writing. At first I was prepared wholeheartedly to support the Outer Worlds, but I finished with a tremendous admiration for the unkempt, "half-monkey" Moreno who saved an interstellar empire and six billion people by his heroic efforts. I still felt sorry for the colonists, though, so inescapably trapped in the web of a false sense of superiority.

4. "Lost Ulysses". Very dramatic and original. The story of the planting of mankind in a new galaxy was very interesting and novel. The ending, however, seemed rather petty for men who had accomplished so much, and surely by the time we can "fantastically rotate an imaginary time-axis" we will be able to compute galactic orbits and ward off the attacks of inferior spaceships.

5. "The Conroy Diary". Fairly good, an average s-f story, but overshadowed by its competitors in this issue. The idea of space travel being funny is new and rather unpalatable. I had hoped to see s-f humorists stick to futuristic football. I can't see what it was that Mallory did that was so wonderful, but all the same this story did present a cleverly conceived plot.

The "short essay" on art in science-fiction in "Brass Tacks" was very good, and I agree with the writer completely. And while the illustrators are changing their techniques, couldn't someone drop them a hint about the eyes of their human figures? For some reason they are always closed, giving one the impression that the characters are all walking in their sleep. The review of "The Lungfish, the Dodo, and the Unicorn" was also fine. I have "The Lungfish and the Unicorn" and hope to get this new revision, since I always liked the original edition. But the article! Those who persist in reading this very much extended article series will probably soon be building electronic calculators in their sleep. I prefer to slumber in peace, and therefore I absolutely refuse to read anything more about electronic calculators for the next six months at least. Surely there is something more on the horizon which is more up the s-f alley than

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electronic calculators! Cosmic ray research, for example, and the new atom-splitters would fill the bill nicely. But please, no more electronic calculators, or I shall be tempted to join those rebels who demand that you ditch the articles in favor of more stories like "Needle", "In Hiding", and "The Undecided." —Warren Carroll, South Berwick, Maine.

The important thing about Tim was that, to reach thirteen successfully, he, at ten, had to pretend to be an ordinary ten-year-old. Which, you'll agree, is harder than pretending to be thirteen!

Dear Sir:

I write again, too late to affect your "Analytical Laboratory" but nevertheless to give you the opinion of one reader on three issues of Astounding. It ought to be four, but my copy of December was stolen.

November: Quite the poorest issue I have seen as regards fiction; and far away the best as regards the articles. Odd! "Expedition Mercy" was just a jumble of symptoms out of a medical textbook. "Love of Heaven" was startlingly poor for Sturgeon. "In Hiding" was far too long for its tenuous idea. "Period Piece" just did not get going. But your Editorial was excellent—I am a wireless engineer myself, of the old days—I can claim to have seen a coherer, not actually in use, but in reserve to be switched in should the electrolytic detector fail—and was in radar during the war, and I had never realized the progress I had seen. Ley was, as ever, first-class; so was the Locke article. By the way, I note with alarm that recent letters from readers have suggested the discontinuance of articles—I hope this is not your policy. They should continue, if only to give the highbrow an excuse when found to be a reader of Astounding. Oh, and congratulations to van Vogt for doing something I thought quite impossible —writing something duller than the "Lensman" stories. Oh, again, must I suggest a subscription for teaching the Editorial staff to read? Shiras definitely makes his boy "thirteen years old", but the blurb at the start makes him—twice—only ten. Come, come. Your artists are now better as regards this; but Orban for "Period Piece" has not read "Dropping the chain".

January: Poor stories compared to your usual standard. "Expedition Polychrome" saved by Cartier's delicious drawings. Asimov the best, but far too long. Article, as usual, excellent.

February: "Seetee Shock" is pretty poor so far—maybe it will improve. "A Present from Joe" is beyond me. Why was Earth suspicious? Why blow up an explorable planet? "Manna" quite delightful. This is another classic—like "Unite And Conquer"—but it must have been an astoundingly good "village library". Other stories average and Youd commendably

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short.—R. J. Raven-Hart, 20 Grant Road, Bangalore, India.

Course VII: Psychohistory Text: A. S-F!

Mr. Campbell:

I found this May issue so outstanding that I am moved to my first letter to Brass Tacks.

I rank the stories thus: 1) "Needle"; 2) "Lost Ulysses"; 3) "Mother Earth"; 4) "The Conroy Diary", and 5) "Prophecy." The short stories rank a poor fourth and fifth but they were such a small proportion of the issue that they detract little from its quality.

During the past few years there have been many examples of good S-F, but in general the turn-out has not been up to what we devotees would like to have as par. To comment in more detail on the stories of the May issue, beginning at the bottom and working up:

"Prophecy": No more than a space-filler. (I hope that is not too unkind.) Perhaps a less jaded reader than I would find something in it.

"The Conroy Diary": No harm done. A slightly pleasant twist, with S-F overtones and a modicum of entertainment value.

"Mother Earth": (We readers of ASF should be qualified for educational credit in the science of psychohistory if this goes on.) Well-written, as Asimov usually is, a clever thesis, and rather plausible—which the Foundation saga is not because of the uncontrolled variables.

"Lost Ulysses": Although not top-drawer science-fiction, this is a good yarn and what is more a breath-taking concept. When you get through it you realize that you've been places. This is, of course, more of a "science-fiction concept" than a story. The beginning is a tour de force, the ending ditto, and in between there is mainly the counterpoint of normal time against tau-lag time and the result it produces. That's all right, however. The idea is the thing here.

"Needle": This is the *piece de resistance* of the issue. One of the most genial extraterrestial being ideas to have come out since I don't know when. Masterfully paced, well written, it proceeds with a life of its own in the development of this fascinating idea of a relationship between two alien life-forms.

Since I have broken the ice, I may as well add a few comments. I would like to see a Heinlein story once in a while. Has he given up dabbling with S-F? And Fritz Lieber Jr. "Gather Darkness" was a classic. Is he a one-shot writer?

E. E. Smith's last opus I found most stimulating until it approached the end. Then it seemed to fall away to nothing. I expected some great Cosmic meaning or philosophy to emerge from the fact of the existence of the Children of the Lens. Nothing did.

I number Van Vogt among the best, but I have grave doubts about

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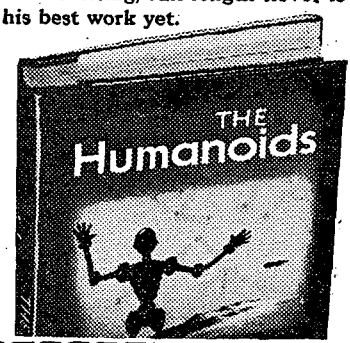

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World of Ā and its sequel. The technique is so hodge-podge. One can't throw together a piece of literature like a salad, with sprigs of Korzybsky adorning it here and there. Interesting as adventure, though.

In general I find that Van Vogt falls down in his longer attempts through sensationalism and a certain kind of characteristic artiness. His strong point is his imagination which is second to none. His series on the Children of the Gods et al was good—his best work in the past five years.

Yours for the coming Golden Age of science-fiction.—Owen R. Loveless, 200 Claremont Avenue, New York 27, New York.

Knowing what happens to them if they leave the party line, I imagine Communist writers very genuinely believe our writers are similarly "disciplined".

Dear Mr. Campbell:

The June issue of Astounding SCIENCE FICTION was an odd one in many ways. First of all, none of the stories were exceptional or outstanding in it and yet the issue as a whole was very pleasant; I should say, highly enjoyable, more-so than most issues. This paradox is made possible, I believe, by the fact that the "impact" of an issue does not consist of the *sum* of its stories but is a product of those *times* many other things; *i.e.*, editorial, article, art work, Brass Tacks, book reviews, et cetera.

The cover is exceptional. There is no doubt about that in my mind. Now, as to the trouble your art staff has had naming the color on the top and bottom bands: "Name it and you can have it," you said. Well, a friend of mine suggested "urple" but, more elaborately, I've decided to call it "the tint of Omar Khayyam", which is a winner, I think. Now, let me have it! At any rate, it's a *mauve*lous cover.

I hope someone accepts your challenge in the editorial. The past few months I have been studying the so-called "Lysenko Controvery", reading much material written by both sides in the matter. Unfortunately, due to my lack of knowledge of things genetical, I have been handicapped in evaluating a great deal of it accurately; I would very much appreciate the type of article you are calling for. My interest in the controversy has been from the point of view of one interested in logic—general semantics—and the "human sciences".

"The Aphrodite Project" was very amusing, but much more obvious than was "The Endochronic Properties of Resublimated Thiotimoline," I'm afraid. Interestingly written, though. Despite my statement about it being "obvious", some people about Los Angeles were fooled.

I enjoyed tremendously the reprint of the review of science fiction from *Literaturnaya Gazyeta;* it

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shows what lengths of distortion are possible when one is not sufficiently familiar with the subject. Perhaps, your readers would be interested to know that this same magazine has taken another swipe in our direction, this time through the agency of one Sergei Gerasimov. Taken from the May 23rd issue of *Time:* "Manhattan's culture provided 'pseudo-scientific pamphlets decorated with a standard cover: a painted man indecently kissing a woman.'" That's rather vague, but I think he means us.

The ANALYTICAL LAB:

1. "Needle," by Hal Clement. An interesting story—at least, a comparatively new idea. The writing, although sufficient wasn't up to standard in parts and the story seemed a little overdrawn. I think that it would have been excellent as a long novelette.

2. "The Green Forest," by A. E. van Vogt. Not up to van Vogt's standard by any means, but that's somewhat excusable on the grounds that it's the first of a series. Van Vogt's series usually get better as they go along.

There was an interesting little mistake in this one: On page 22, protagonist Marenson is tied up and lying on the ground. On page 26, he gets up and walks away without ever having untied himself. Something I missed, maybe?

3. "Minority Report," by Theodore Sturgeon. Grudge is one of the first interesting science-fictional characters to come along in a long while. Many little things fascinated me about this story. Sturgeon's a good boy.

4. "A Sound Investment," by René Lafayette. A pun, yet! And you, too! This is one of the best of the series. I hope Lafayette won't consider me unkind, if I say that that isn't saying much.

5. "To Watch The Watchers," by W. Macfarlane. Ten to one, this is another pseudonym of Hubbard's! Pleasant.

6. "Entity," by Poul Anderson and John Gergen. Hm-m-m.

Next issue sounds swell.

See you then.—Arthur Jean Cox, 628 S. Bixel Street, Los Angeles 14, California.

Hm-m-m— They should have used a regenerative circuit with the thiotimoline in the feedback loop!

Dear Mr. Campbell:

I just received the very excellent June issue. Having skimmed through only once as yet, I'll not try to rate anything, but the "Aphrodite Project" was fine, and the problem looks as though it will prove excellent. Please let us have more problems.

It gives me great pleasure to be able to say that I have finally secured permission from the Department of War to let you in on what has been called the "Paradox Project". This was possible only because you yourself have been running very close to the project, and it was feared that you would stumble

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on to it at any time. This naturally would have created a somewhat embarrassing situation if security were to have been maintained. Since no immediate military results seem possible at this time, this course of action is now entirely permissible.

First, however, I'm sorry to have to tell you that you have been made the victim of a hoax. A letter preports to tell of neurotic reactions on the part of thiotimoline when presented with the insoluble dilemma of having its reaction prevent the stimulus or lack of same cause same.

This situation was first postulated by Norman Martinosauce at the University of Chicago on the evening when your article first called resublimated thiotimoline to our attention. (Indeed, this was scarcely five minutes before "Project Paradox" was first conceived.) The situation was carefully investigated from theoretical viewpoints.

A hypothesis was agreed upon the next evening, and the experiment performed eight days later, the delay being caused by difficulty in procuring pure enough samples of the material. Our hypothesis proved correct in three out of three experiments, and has been verified many times since then.

Ordinarily, a certain discreet number of probability lines project from each space-time quanta. This goes on and on, analogously to the familiar branching idea in SF. In this type of instance, we reasoned, the lines contradicted, and so probably actually crossed back on each other. In other words, instead of each of the lines extending into a new first-order infinity of space-time quanta, they simply ran into each other, head on.

This hypothesis was favored because it not only resolved the dilemma—as the lines would not go down the branching system, the dilemma would never occur in this sytsem, which is the universe we know—but because it also completely explained the startling endochronic behavior of the thiotimoline in general.

As I have said, the prediction proved completely correct. The thiotimoline simply disappeared. Although it is too involved to prove here, there is really no amendment needed in the law of conservation of energy either. Each half of the symmetrical wavicles out of which the thiotimoline ultimately is "constructed" rotated 180 degrees and became the other half going back through time.

Therefore, as any fool can plainly see, Mr. Lindfiolm's letter was nothing but a pack of lies. Personally, I strongly suspect that it was a cheap publicity trick for some sort of new religious cult he is planning to start which will involve the worship of a thiotimoline god.

The aim of "Project Paradox" has been to build a prediction machine. At first it was hoped that we could build a television camera which would see perhaps a thousand

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years into the future. The mechanics should be obvious.

A photocell causes water to be injected into a batch thio. The normal part of the reaction occupies a shorter interval of positive time than the thiotimoline part does of negative time. Thus, the solution goes opaque a short period of time before the cell starts things at all.

We use the first such reactor to trigger the cell of a second reactor. The thiotimoline in it thus clouds over two periods before the initial cell receives its impulse. By setting enough reactors in series, it is possible to get the thiotimoline in the last cell to dissolve any arbitrarily great period of time before the first cell is stimulated by whatever we will be interested in outside of the system.

Due to mechanical difficulties, however, it was not possible to gain much over .01 seconds per reactor. To get any sort of visual image would, of course, require many thousands of such series. It rapidly appeared that the cost would be prohibitive, even to the government.

The project was then converted into one purely of research. We concentrated on building just one series of reactors. This would give us a two-valued look into the situation as regards intensity of light in here-then, then going further into the future as the length of the series increased.

Our contract with the government was such that we were to work an eight-hour day, and that the lights must be out by that time. (The government handled all such expenses directly.) This kept us pushing the end of our series through the dark two thirds of the time, thus cutting us down to two and two thirds hours of actual observation per day. The army officer in charge refused to give us permission to proceed on longer hours, however, on the grounds that electricity, et cetera costs money and he was on a budget.

We finally achieved a series almost one hundred thousand reactors long before the project was closed down. The reason for its sudden demise was a government auditor.

I am unable to quite follow his mathematics, but it seems he demonstrated that it would be cheaper to invest the money and just sort of wait for the future to come by. I regard this as rather short-sighted, but his opinion was final.

The entire group of us are now looking for someone to finance the continuation of the research on a private basis. It will be necessary to begin anew. The series we did construct is not available, as the auditor had it torn down for quick turnover on the surplus market. However, the cost will only be one ninth what it was for labor—and that was our major cost—if we are allowed to run on a twenty-four hour basis. If you know of any eccentric millionaires who would be interested, I would appreciate hearing from you on this matter.

As I said, you are authorized to print all or any parts of this.—

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W. M. Keese, Jr., 2410 Pacific, San Francisco, California.

"Project Aphrodite" was, of course, an article in fiction form. It hasn't happened—YET. But the Russian review was an exact quotation of an actual article.

Dear Mr. Campbell:

I suppose "The Aphrodite Project" was strictly out of the imagination of some writer—for the quite simple reason that in the present struggle for power between the various branches of the armed forces, I cannot imagine any arm or service passing up such a wonderful chance for front-page publicity—but I somehow hope it isn't a gag. The editorial writers and the university professors—of which I seem to know far too many—have been giving me a hard way to go on my often-voiced prophecy that I would live to see the first manned rocket land on the Moon. If "Aphrodite" were true, I could shut 'em up—for a few minutes at least.

I assumed, also, when I began to read it, that the *Review of the Literary Gazette,* was also a gag. But when they began to talk about R. Williams and a story, "The Incredible Pebbles," a yarn about a moronic little boy with a sling shot wandering through a future atomic bomb factory and using miniature atomic bombs as ammunition for his sling shot, I began to get an uneasy feeling. I actually wrote that story. This is the first time I have ever been called a lackey of Wall Street, and I can stand it, but I wish by some means or other I could tell the boys on the other end what I think of them. Up in that part of Boston which was once called Roxbury, on the wall of the old First Church, is a marble plaque headed ROBERT WILLIAMS, who happens to have been my tenth great grandfather. If I should embrace or countenance any form of totalitarian government, including specifically Communism, I do not doubt that this plaque would fall from the wall and also that there would be a great stirring and heaving in the old burying grounds all over New England as the tribe of Gwylhym came forth from their graves to explain to me the error of my ways. There is tyranny behind me but it is over three centuries away. I don't want it, in any form whatsoever, to get any closer than that.

It therefore makes me feel good to know—presuming the review was not a gag—that the Communists have attacked me. While I have never yet put into any of the three hundred and more stories I have published any deliberate political propaganda, I have also never failed to put in one thing—the dignity of the individual. I agree completely with Tully Kloote: "It is a proud and lonely thing to be a man." It is also, in these days, becoming increasingly a quite necessary thing.—Robert Moore Williams.

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DEFENSE MECHANISM

BY KATHERINE MAC LEAN

Telepathic power would be a wonderful gift—or is it? There might be some question as to whether it, and its possessor, could survive, after all . . .

Illustrated by Brush

The article was coming along smoothly, words flowing from the typewriter in pleasant simple sequence, swinging to their predetermined conclusion like a good tune. Ted typed contentedly, adding pages to the stack at his elbow.

A thought, a subtle modification of the logic of the article began to glow in his mind, but he brushed it aside impatiently. This was to be a short article, and there was no room for subtlety. His articles sold, not for depth, but for an oddly individual quirk that he could give to commonplaces.

While he typed a little faster, faintly in the echoes of his thought, the theme began to elaborate itself richly with correlations, modifying qualifications, and humorous parenthetical remarks. An eddy of especially interesting conclusions tried to insert itself into the main stream of his thoughts. Furiously he typed along the dissolving thread of his argument.

"Shut up," he snarled. "Can't I have any privacy around here?"

The answer was not a remark, it was merely a concept; two electrochemical calculators pictured with the larger in use as a control mech, taking a dangerously high inflow, and controlling it with high resistance and blocs, while the smaller one lay empty and unblocked, its unresistant circuits ramifying any impulses received along the easy channels of pure calculation. Ted recognized the diagram as something borrowed from his amateur concepts of radio and psychology.

"All right. So I'm doing it myself. So you can't help it!" He grinned grudgingly. "Answering back at your age!"

Under the impact of a directed thought the small circuits of the idea came in strongly, scorching

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their reception and rapport diagram into his mind in flashing repetitions, bright as small lightning strokes. Then it spread and the small other brain flashed into brightness, reporting and repeating from every center. Ted even received a brief kinesthetic sensation of lying down, before it was all cut off in a hard bark of thought that came back in the exact echo of his own irritation.

"Tune down!" It ordered furiously. "You're blasting in too loud and jamming everything up! What do you want, an idiot child?"

Ted blanketed down desperately, cutting off all thoughts, relaxing every muscle, but the angry thoughts continued coming in strongly a moment before fading.

"Even when I take a nap," they said, "he starts thinking at me! Can't I get any peace and privacy around here?"

Ted grinned. The kid's last remark sounded like something a little better than an attitude echo. It would be hard to tell when the kid's mind grew past a mere selective echoing of outside thoughts, and became true personality, but that last remark was a convincing counterfeit of a sincere kick in the shin. Conditioned reactions can be efficient.

All the luminescent streaks of thought faded and merged with the calm meaningless ebb and flow of waves in the small sleeping mind. Ted moved quietly into the next room and looked down into the blue-and-white crib. The kid lay sleeping, his thumb in his mouth and his chubby face innocent of thought. Junior—Jake.

It was an odd stroke of luck that Jake was born with this particular talent. Because of it they would have to spend the winter in Connecticut, away from the mental blare of crowded places. Because of it Ted was doing free-lance in the kitchen, instead of minor editing behind a New York desk. The winter countryside was wide and windswept, as it had been in Ted's own childhood, and the warm contacts with the stolid personalities of animals through Jake's mind were already a pleasure. Old acquaintances —Ted stopped himself skeptically. He was no telepath. He decided that it reminded him of Ernest Thompson Seton's animal biographies, and went back to typing, dismissing the question.

It was pleasant to eavesdrop on things through Jake, as long as the subject was not close enough to the article to interfere with it.

Five small boys let out of kindergarten came trouping by on the road, chattering and throwing pebbles. Their thoughts came in jumbled together in distracting cross currents, but Ted stopped typing for a moment, smiling, waiting for Jake to show his latest trick. Babies are hypersensitive to conditioning. The burnt hand learns to yank back from fire, the unresisting mind learns automatically to evade too many clashing echoes of other minds.

Abruptly the discordant jumble

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of small boy thoughts and sensations delicately untangled into five compartmented strands of thoughts, then one strand of little boy thoughts shoved the others out, monopolizing and flowing easily through the blank baby mind, as a dream flows by without awareness, leaving no imprint of memory, fading as the children passed over the hill. Ted resumed typing, smiling. Jake had done the trick a shade faster than he had yesterday. He was learning reflexes easily enough to demonstrate normal intelligences. At least he was to be more than a gifted moron.

A half hour later, Jake had grown tired of sleeping and was standing up in his crib, shouting and shaking the bars, Martha hurried in with a double armload of groceries.

"Does he want something?"

"Nope. Just exercising his lungs." Ted stubbed out his cigarette and tapped the finished stack of manuscript contentedly. "Got something here for you to proofread."

"Dinner first," she said cheerfully, unpacking food from the bags. "Better move the typewriter and give us some elbow room."

Sunlight came in the windows and shone on the yellow table top, and glinted on her dark hair as she opened packages.

"What's the local gossip?" he asked, clearing off the table. "Anything new?"

"Meat's going up again," she said, unwrapping peas and fillets of mackerel. "Mrs. Watkin's boy, Tom, is back from the clinic. He can see fine now, she says."

He put water on to boil and began greasing a skillet while she rolled the fillets in cracker crumbs. "If I'd had to run a flame thrower during the war, I'd have worked up a nice case of hysteric blindness myself," he said. "I call that a legitimate defense mechanism. Sometimes it's better to be blind."

"But not all the time," Martha protested, putting baby food in the double boiler. In five minutes lunch was cooking.

"Whaaaa—" wailed Jake.

Martha went into the baby's room, and brought him out, cuddling him, and crooning, "What do you want, Lovekins? Baby isn't hungry yet, is ims. Baby just wants to be cuddled, doesn't baby."

"Yes," said Ted.

She looked up, startled, and her expression changed, became withdrawn and troubled, her dark eyes clouded in difficult thought.

Concerned, he asked: "What is it, Honey?"

"Ted, you shouldn't—" She struggled with words. "I know, it is handy to know what he wants, whenever he cries. It's handy having you tell me, but I don't— It isn't right somehow. It isn't *right.*"

Jake waved an arm and squeaked randomly. He looked unhappy. Ted took him and laughed, making an effort to sound confident and persuasive. It would be impossible to raise the kid in a healthy way if

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Martha began to feel he was a freak. "Why isn't it right? It's normal enough. Look at E. S. P. Everybody has that, according to Rhine."

"E. S. P. is different," she protested feebly, but Jake chortled and Ted knew he had her. He grinned, bouncing Jake up and down in his arms.

"Sure it's different," he said cheerfully. "E. S. P. is queer. E. S. P. comes in those weird accidental little flashes that contradict time and space. With clairvoyance you can see through walls, and read pages from a closed book in France. E. S. P., when it comes, is so ghastly precise it seems like tips from old Omniscience himself. It's enough to drive a logical man insane, trying to explain it. It's illogical, incredible, and random. But what Jake has is just limited telepathy. It is starting out fuzzy and muddled and developing towards accuracy by plenty of trial and error, like sight, or any other normal sense. You don't mind communicating by English, so why mind communicating by telepathy?"

She smiled wanly. "But he doesn't weigh much, Ted. He's not growing as fast as it says he should in the baby book."

"That's all right. I didn't really start growing myself until I was about two. My parents thought I was sickly."

"And look at you now." She smiled genuinely. "All right, you win. But when does he start talking English? I'd like to understand him, too. After all I'm his mother!"

"Maybe this year, maybe next year," Ted said teasingly. "I didn't start talking until I was three."

"You mean that you don't want him to learn," she told him indignantly, and then smiled coaxingly at Jake. "You'll learn English soon for Mummy, won't you, Lovekins?"

Ted laughed annoyingly. "Try coaxing him next month or the month after. Right now he's not listening to all these thoughts, he's just collecting associations and reflexes. His cortex might organize impressions on a logic pattern he picked up from me, but it doesn't know what it is doing any more than this fist knows that it is in his mouth. That right, bud?" There was no demanding thought behind the question, but instead, very delicately, Ted introspected to the small world of impression and sensation that flickered in what seemed a dreaming corner of his own mind. Right then it was a fragmentary world of green and brown that murmured with wind.

"He's out eating grass with the rabbit." Ted told her.

Not answering, Martha started putting out plates. "I like animal stories for children," she said determinedly. "Rabbits are nicer than people."

Putting Jake in his pen, Ted began to help. He kissed the back of her neck in passing. "Some people are nicer than rabbits."

Wind rustled tall grass and tan-

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gled vines where the rabbit snuffled and nibbled among the sun-dried herbs, moving on habit, ignoring the abstract meaningless contact of minds, with no thought but deep content.

Then for a while Jake's stomach became aware that lunch was coming, and the vivid business of crying and being fed drowned the gentler distant neural flow of the rabbit.

Ted ate with enjoyment, toying with an idea fantastic enough to keep him grinning, as Martha anxiously spooned food into Jake's mouth. She caught him grinning and indignantly began justifying herself. "But he only gained four pounds, Ted. I have to make sure he eats something."

"Only!" he grinned. "At that rate he'd be thirty feet high by the time he reaches college."

"So would any baby." But she smiled at the idea, and gave Jake his next spoonful still smiling. Ted did not tell his real thought, that if Jake's abilities kept growing in a straight-line growth curve, by the time he was old enough to vote he would be God, but he laughed again, and was rewarded by an answering smile from both of them.

The idea was impossible, of course. Ted knew enough biology to know that there could be no sudden smooth jumps in evolution. Smooth changes had to be worked out gradually through generations of trial and selection. Sudden changes were not smooth, they crippled and destroyed. Mutants were usually monstrosities.

Jake was no sickly freak, so it was certain that he would not turn out very different from his parents. He could be only a little better. But the contrary idea had tickled Ted and he laughed again. "Boom food," he told Martha. "Remember those straight-line growth curves in the story?"

Martha remembered, smiling, "Redfern's dream—sweet little man, dreaming about a growth curve that went straight up." She chuckled, and fed Jake more spoonfuls of strained spinach, saying, "Open wide. Eat your boom food, darling. Don't you want to grow up like King Kong?"

Ted watched vaguely, toying now with a feeling that these months of his life had happened before, somewhere. He had felt it before, but now it came back with a sense of expectancy, as if something were going to happen.

It was while drying the dishes that Ted began to feel sick. Somewhere in the far distance at the back of his mind a tiny phantom of terror cried and danced and gibbered. He glimpsed it close in a flash that entered and was cut off abruptly in a vanishing fragment of delirium. It had something to do with a tangle of brambles in a field, and it was urgent.

Jake grimaced, his face wrinkled as if ready either to smile or cry. Carefully Ted hung up the dish towel and went out the back door,

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picking up a billet of wood as he passed the woodpile. He could hear Jake whimpering, beginning to wail.

"Where to?" Martha asked, coming out the back door.

"Dunno." Ted answered. "Gotta go rescue Jake's rabbit. It's in trouble."

Feeling numb he went across the fields, through an outgrowth of small trees, climbed a fence into a field of deep grass, and thorny tangles of raspberry vines, and started across.

A few hundred feet into the field there was a hunter sitting on an outcrop of rock, smoking, with a successful bag of two rabbits dangling near him. He turned an inquiring face to Ted.

"Sorry," Ted told him rapidly, "but that rabbit is not dead yet. It can't understand being upside down with its legs tied." Moving with shaky urgency he took his penknife and cut the small animal's pulsing throat, then threw the wet knife out of his hand into the grass. The rabbit kicked once more, staring still at the tangled vines of refuge, then its nearsighted baby eyes lost their glazed bright stare and became meaningless.

"Sorry," the hunter said. He was a quiet-looking man with a sagging, middle-aged face.

"That's all right," Ted replied, "but be a little more careful next time, will you? You're out of sea-

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son anyhow." He looked up from the grass to smile stiffly at the hunter. It was difficult. There was a crowded feeling in his head, like a coming headache, or a stuffy cold. It was difficult to breathe, difficult to think.

It occurred to Ted then to wonder why Jake had never put him in touch with an adult. After a frozen stoppage of thought he laboriously started the wheels again and realized that something had put them in touch with the mind of the hunter, and that was what was wrong. His stomach began to rise. In another minute he would retch.

Ted stepped forward and swung the billet of wood in a clumsy sidewise sweep. The hunter's rifle went off and missed as the middle-aged man tumbled face first into the grass.

Wind rustled the long grass and stirred the leafless branches of trees. Ted could hear and think again, standing still and breathing in deep, shuddering breaths of air to clean his lungs. Briefly he planned what to do. He would call the sheriff and say that a hunter hunting out of season had shot at him and he had been forced to knock the man out. The sheriff would take the man away, out of thought range.

Before he started back to telephone he looked again at the peaceful, simple scene of field and trees and sky. A memory of horror came into clarity. The hunter had been psychotic.

Thinking back, Ted recognized parts of it, like faces glimpsed in writhing smoke. The evil symbols of psychiatry, the bloody poetry of the Golden Bough, that had been the law of mankind in the five hundred thousand lost years before history. Torture and sacrifice, lust and death, a mechanism in perfect balance, a short circuit of conditioning through a glowing channel of symbols, an irreversible and perfect integration of traumas. It is easy to go mad, but it is not easy to go sane.

"Shut up!" Ted had been screaming inside his mind as he struck. "Shut up."

It had stopped. It had shut up. The symbols were fading without having found root in his mind. The sheriff would take the man away out of thought reach, and there would be no danger. It had stopped.

The burned hand avoids the fire. Something else had stopped. Ted's mind was queerly silent, queerly calm and empty, as he walked home across the winter fields, wondering how it had happened at all, kicking himself with humor for a suggestible fool, not yet missing—Jake.

And Jake lay awake in his pen, waving his rattle in random motions, and crowing "glaglagla gla—" in a motor sensory cycle.

He would be a normal baby, as Ted had been, and as Ted's father before him.

And as all mankind was "normal."

THE END

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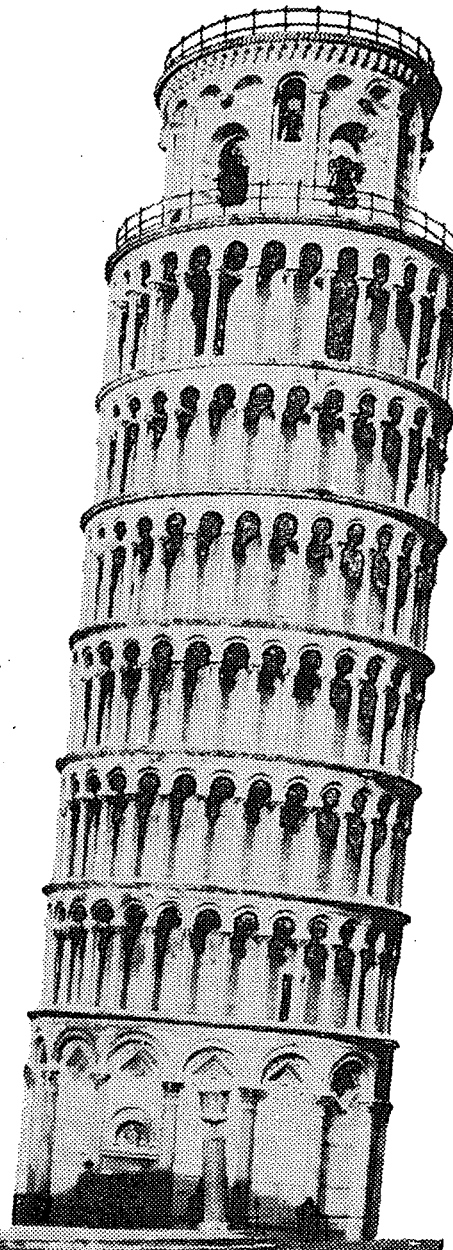

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